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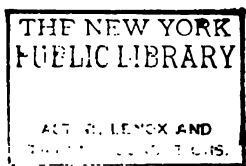
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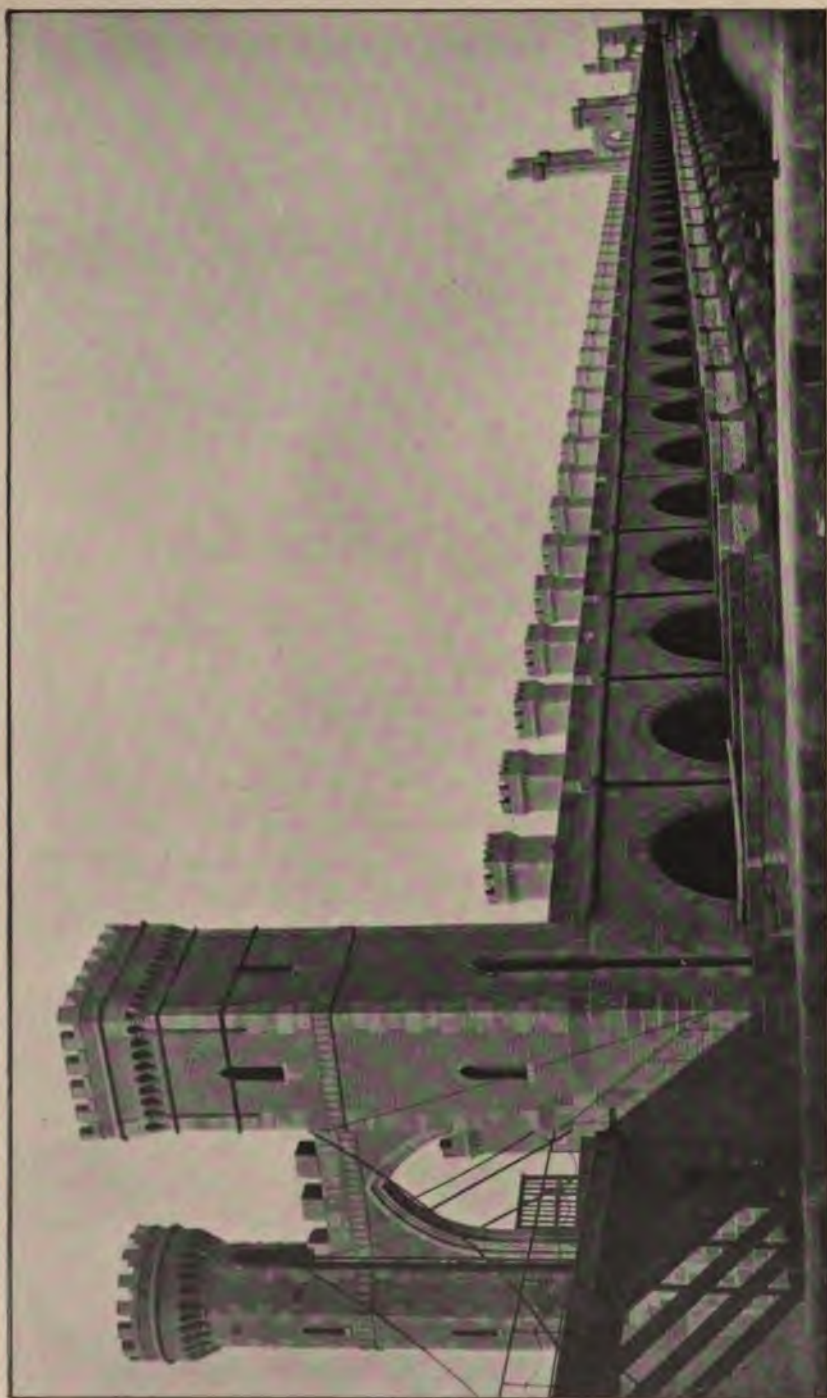
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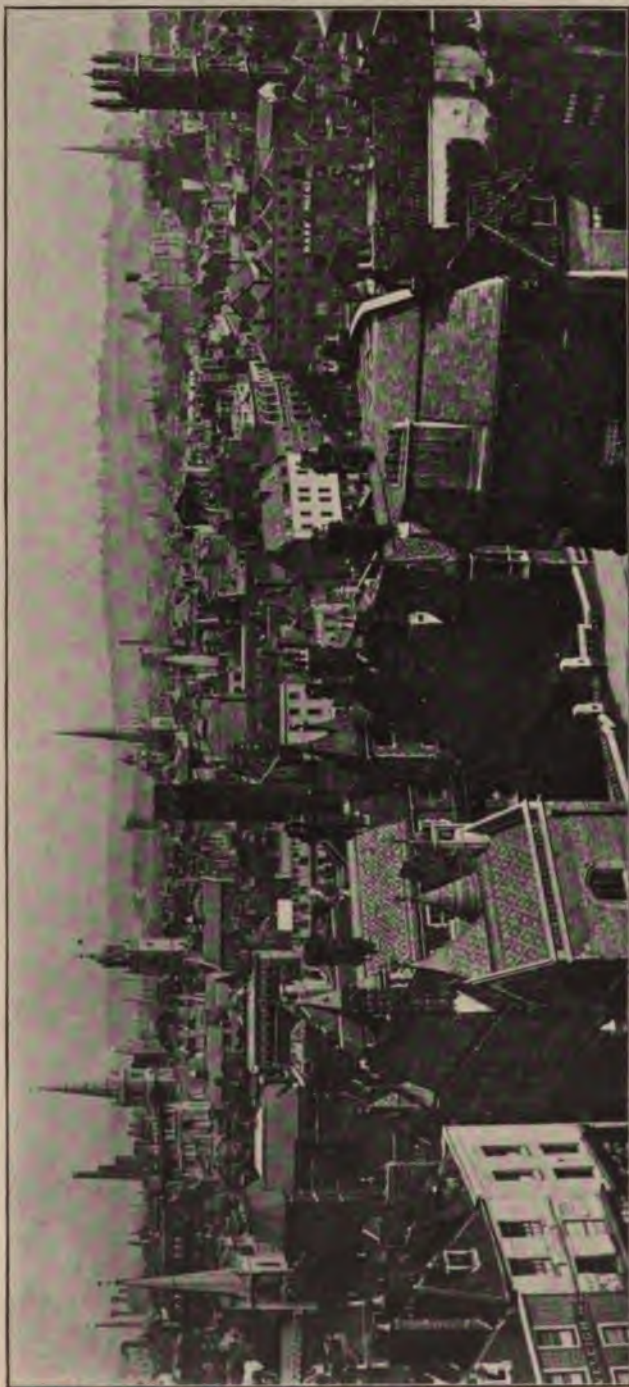
NUMBER 1.

THE ANCIENT CITY OF BRISTOL, ENGLAND.



THE OLD MINT, BRISTOL, ENGLAND.

HAS been fixed upon by the British Association for the Advancement of Science as their place of meeting between September 7 and 14 of the present year. Last year the Association met in Canada, at Toronto, and the local committee charged with the arrangements at Bristol are making special efforts to obtain a representative gathering of visitors from Canada and the United States. Bearing in mind the close connection which has always existed between Bristol and the Trans-Atlantic ports, it may be hoped that these efforts will be successful. A line of steamers has been for some years running between Bristol and New York, and another has been lately put on between Bristol and Boston. An expenditure of \$7,500,000 is contemplated to extend accommodation at the Avonmouth docks, near Bristol, with a special view to the Trans-Atlantic trade. Science and trade and commerce go hand in hand and it may be worth while for business men in the United States to take advantage of the great gathering at Bristol to bring the economic advantages of their position prominently under the notice of an



GENERAL VIEW OF THE CITY OF BRISTOL, ENGLAND.

active, growing community like that to be found in Bristol. History seems to be repeating itself, for so long ago as the last quarter of the fifteenth century an extraordinary fever for Western enterprise seized the merchants of Bristol. In 1480, twelve years before the embarkation of Columbus, there is contemporary evidence that John Jay, one of a well-known Bristol family, fitted out a little ship under the command of a skilful mariner, and despatched it "in search of the island of Brasylle," which in general belief lay somewhere to the west of Ireland. This was no exceptional endeavor. In 1498 the Spanish envoy in London informed Ferdinand and Isabella that for the preceding seven years the men of Bristol had sent out every year two, three, or four light vessels "in search of the island of Brasylle and the Seven Cities, according to the fancy of that Italian, Ca-



ENTRANCE TO THE DOCKS, BRISTOL, ENGLAND.

bot," and that they still continued the practice. He was not aware that Cabot's "fancy" had already borne fruit.

In 1496 John Cabot was granted a patent by Henry VII., authorizing him, with his sons, Lewis, Sebastian, and Sanctus, to seek for unknown lands. He was probably induced to seek for this concession by his patrons in Bristol. At all events they provided him with a ship, with a crew of eighteen men, properly furnished, and on the 2nd of May, 1497, the *Matthew* sailed from the port on her memorable voyage of discovery.

Unlike Columbus, who always steered south-westward, Cabot appears to have driven straight across the Atlantic, for on the 24th of June he reached the North American continent, and sailed along the coast as far as "Cape Florida," whence he immediately turned his helm on his homeward voyage, and re-entered the Avon in safety on the 6th of August. It is now universally admitted that Cabot anticipated Columbus in the discovery of the American mainland.

The people of Bristol are now raising a monument in commemoration of the achievement. The foundation stone was laid by the Marquis of Dufferin and Ava on the fourth centenary of the discovery, on the 24th of June, 1897, and the same nobleman will formally open the tower during the week of the British Association meeting.

The ancient buildings of Bristol are of special interest to architects and builders in stone. The Cathedral was founded in 1142, and the old Abbey Gateway is a fine specimen of Norman handiwork. The four receding orders are elaborately enriched with zigzag and other mouldings, and an interlacing arcade lines the passage within. The design of the Cathedral, which is set down to Abbot Knowle, is of daring originality, and has seldom, if ever, been adopted since. The side aisles of all the great Gothic churches of Europe were, and still are, much inferior in height to the central choir and nave, thus admitting the two latter to be lighted by a row of windows above the aisle roofs, known as the clerestory, but to carry up his side aisles to the full height of the central church, necessitating feats of engineering skill as masterly as they were novel, the lateral thrust of the middle vault was overcome by a beam of stone—a sort of flat flying buttress—carried across each bay of the aisles to the external buttresses, the dimensions of which were consequently of extraordinary magnitude. The effect is disappointing when the church is examined from without, giving it the appearance rather of a large college chapel than that of a cathedral; but the effect of space, light and wondrous beauty and harmony within never fails to impress the visitor.

The perpendicular tower of St. Stephen's Church is remarkable for the absence of buttresses, giving it the appearance of a Gothic version of the Italian Campanile, and is one of the most elaborate in the West of England.



ST. MARY, REDCLIFFE CHURCH, BRISTOL, ENGLAND



THE CATHEDRAL, BRISTOL, ENGLAND



TEMPLE CHURCH, BRISTOL, ENGLAND

It was erected by the munificence of John Shipward, one of Canynges wealthy contemporaries, and mayor of Bristol in 1463. The porch at its base is richly finished and has a fan tracery vaulting.

The church of St. John the Baptist is especially worthy of notice as being the only existing example of the manner in which four of the original gates of the town were devoted to ecclesiastical purposes when they ceased to be serviceable for defense. In other cases the church or chancel was placed over the archways; in this instance, as on the west, the gate could only be used as a base for the tower.

A curious feature of another ancient church, that of Temple, is its leaning tower, which was formerly almost as fine as that of St. Stephen's, but has been deprived of its turrets and pinnacles and is only 113 feet in height. The top overhangs the base about five feet. This singularity is first mentioned in 1568, when the Duke of Norfolk visited the city. It was then customary show strangers that a stone as large as an egg, thrust into a chink between the tower and the church wall, would be crushed to powder when the bells were rung, and the Duke was a witness of the experiment.

Modern Bristol also presents many features of interest. The exchange is a good specimen of the classical architecture of the last century. The quadrangle, which is capable of holding about 1,500 persons, was, until recent legislative reforms, the place where nominations of candidates took place at parliamentary elections, and has witnessed many tumultuous scenes. Merchants, oddly enough, never took kindly to the building for mercantile gatherings, and ended by abandoning it altogether. It was then converted into a corn market, and of late years has been rendered comfortable by being covered by an ornamental roof. In front of the façade are four curious bronze pillars, bearing inscriptions and arms of their seventh century donors, formerly used by merchants for paying money and signing documents when business was chiefly conducted in the open street.

The Merchants' Hall belongs to a wealthy and important guild of merchants, which was an influential confederacy so early as the days of Edward II., when it appears to have obtained a predominance in municipal affairs, and to have practically deprived the burgesses of their previous privilege of electing the mayor and bailiffs. The usurpation led to a remarkable incident that has been overlooked by English historians. The burghers rebelled, first against the dictators, and next against the weak king who supported them, built a "wall of defense" between themselves and the castle, elected corporate officials satisfactory to themselves, collected and expended the customs of the port, and set the royal authority at defiance for upwards of two years. There was, in short, a civil war on a small scale. At last the town was reduced by a regular siege, and a heavy fine was extorted from the rebellious inhabitants before they were granted a pardon



FINKELSTEIN ART ACADEMY, BRISTOL, ENGLAND.



THE VICTORIA ROOMS, BRISTOL, ENGLAND.



CLIFTON DOME HOTEL, BRISTOL, ENGLAND.



SUSPENSION BRIDGE, CLIFTON, BRISTOL, ENGLAND.



THE NORMAN ARCHWAY, ST. AUGUSTINE'S, BRISTOL, ENGLAND.



ST. AUGUSTINE'S BRIDGE, BRISTOL, ENGLAND.
(With Tower of St. Stephen's Church in Background.)

and the restoration of their former chartered rights. The "Great Insurrection" was not, however, a failure. The merchants had received a sharp lesson, and municipal affairs were henceforth conducted with more regard for public opinion. For the next two centuries the Merchants' Company seems to have been a committee on trade for the corporation, controlled by it in appearance, though probably not in fact, for the controllers were, many of them, merchants themselves.

In 1552 a nominal separation took place between the two bodies, a charter being obtained from Edward VI., instituting an independent incorporation under the title of the Master, Wardens, and Commonalty of Merchant Venturers, and an Act of Parliament was passed in the Eighth Elizabeth, confirming the privileges conceded to this body, in whom was vested a monopoly of the mercantile trade of the city. To this, however, the municipal corporation now become more representative of the public feeling, strongly objected, and the Act was repealed in the next Parliament. The Merchant Venturers were granted fresh charters by Charles I. and Charles II., and, though they never succeeded in suppressing the competition of those outside their confederacy, they long gathered in nearly all the leading merchants of the port and gradually increased in influence and wealth. Their first hall was established in a chapel dedicated to St. Clement, but desecrated at the suppression of the chantries. The present hall, unpretentious outwardly, but stately within, was built in 1701, and refronted ninety years later. It has long been celebrated for the costly entertainments offered by the company to distinguished visitors.

Within recent years the Society has made a munificent contribution to the educational institutions of the city by founding a College of Technical Science and Art, equipped with laboratories and engineering and other workshops, drawing schools, etc., with a large staff of competent teachers. Attached is a second grade school of an equally efficient character. The institution, which is supposed to have cost the company little short of £40,000, was established upon a pre-existing Trades' School, the first of its class in England, opened 1856.

Arthur Lee.

CORAL ISLANDS.



NEW interest in the curious and puzzling coral reefs and islands of the Pacific Ocean has recently been awakened by the return of Prof. Alexander Agassiz from a visit to the Fiji Islands, where by means of boring instruments, the coral reefs were penetrated to great depths, resulting in the discovery of many new and interesting facts bearing on the origin of these islands. Coral reefs and islands, as is well known, are of many kinds. Close to the shore of the land, and connected with it, are the *fringing reefs*, which extend seaward as a sort of platform lying just below the surface of the water, and terminate finally, at their outer margin, in an abrupt slope or escarpment, whose base may be hundreds of fathoms below. The late Prof. J. D. Dana has given an instance where the lead used in sounding stopped for an instant at a depth of 350 fathoms, then slipped off and descended to 600 fathoms without reaching bottom, showing the perpendicular or even overhanging nature of the coral barriers. In many cases in addition to the fringing reef there is another reef, often from ten to fifty miles from the land, and known as the *barrier reef*. Inclosed within these barrier reefs are stretches of quiet water where, during the fierce storms of the Pacific, ships may find safety from the waves of the open sea. A third class of coral reefs, the *atolls*, possess by far the greatest interest. These are narrow rims of coral rock, rising usually but a few feet above the waves, and inclosing a comparatively shallow lake or lagoon of salt water. They vary from one to fifty or more miles in diameter, and are of all shapes, some being highly irregular and angular, and others nearly circular. Into the inclosed lagoon are usually passages through which ships may enter.

The living substance of the coral animal, or *polyp*, as it is more properly called, is a soft, translucent, jelly-like substance, which, however, has the power of secreting from the sea water small quantities of lime, from which is built up a framework, having to the coral the same relation that the skeleton has to the higher animals. The coral reef represents an accumulation of such stony skeletons, which numberless polyps on dying have left behind. These polyps vary greatly in size. Some, like the mushroom coral, may be over a foot in diameter, but it is safe to say that the great majority are under a half inch in diameter, and may be in cases almost microscopic. The smaller varieties, however, make up for their

lack of size by the rapidity with which they multiply by buds and branches, and by the wonderful vitality by which each fragment of a polyp, ground to pieces by the waves, has the power to reproduce the lost parts, thus forming a new organism capable of performing all the functions of the original.

The puzzling feature of the coral atoll is found in the fact that, while the coral polyp will only flourish in water less than one hundred feet in depth, the atolls and reefs rise from depths many times greater. Indeed in the Ellice Islands, borings have been made to a depth of over 700 feet without passing out of coral rock, and it has long been known that the reefs and atolls often rise from almost unfathomable depths.

The first explanation which naturally suggested itself was that the coral growth was simply a capping, as it were, to mountain peaks and land masses reaching nearly, but not quite, to the surface of the water. The atolls were supposed to mark the rims of extinct and submerged volcanoes. The great size of some of the atolls, the diameters of which have been known to be more than fifty miles, and the immense number of them, from the first made this view an unsatisfactory one. Darwin, during the famous voyage around the world in the *Beagle*, came to the conclusion that the great thickness of coral could only be formed on a sea bottom which was slowly sinking, so slowly in fact, that the coral was built up as fast as the land sank. Thus a coral reef becomes simply a living colony of coral polyps, resting and growing upon the top of an immense mass made up of the calcareous remains of corals of past ages, perhaps even millions of years before. More recently Murray, of the *Challenger* expedition, has doubted the necessity of assuming a submergence to account for the coral islands. Accumulations of the shells of marine animals, or the remains of cinder cones of old volcanoes which have been worn away by the sea, might in many cases afford favorable sites for coral growth. The growth would continue only to low tide level, all future increase in height being due to the action of the waves, which in time of storm beat heavily upon the reef and throw large quantities of coral fragments, sometimes of great size, upon the top of the reef, which in this way is often built up several feet above the surface of the sea. The growth of the coral is favored by the action of the waves and spreads most rapidly towards the sea, forming a sort of ring through which the sea finally forces a passage. Once on the inside, according to the views of Murray, currents of water would be established which would soon dissolve out the center, leaving a narrow ring of coral surrounding a lagoon, in other words a perfect atoll. Against this view it has been urged with success that the depth of the lagoons is often far too great to be due to such action. Dana has also shown, that in some instances at least, not only were the lagoons not deepening, but by the deposit of coral

sand formed by the action of the waves were actually filling up.

The true explanation probably lies sometimes with one theory, sometimes with another. The great thickness of the coral rocks, such as shown by the borings in the Ellice Islands can only have been deposited during such a subsidence as that claimed by Darwin. Agassiz's recent borings have shown that perhaps a thickness of not over fifty feet of the coral is of recent origin—the rest being of a past geological age—but that does not affect the essential element of Darwin's explanation, namely the subsidence.

Again, it is well established that in Florida and elsewhere, coral reefs have been found in regions which have undergone no subsidence, and in such regions, the explanation offered by Murray, or at least parts of it, is probably a true one. Even the crater theory, so long regarded with skepticism, has by the exploration of Agassiz been shown to be quite within the range of possibility, or even probability, as an explanation of many of the islands of the Fiji group.

Myron L. Fuller.

THE BARRAGE DU NIL *

THE irrigation works of India and Egypt are very extensive, and the stone bridges or aqueducts are very notable pieces of engineering.

The Barrage du Nil is in reality a series of automatic weirs, over which a bridge has been constructed. The original design was made by a French engineer, M. Mougel-Bey, in 1843, and while work was prosecuted in a desultory manner for several years, it was not entirely completed before being used. The English practically reconstructed it in the eighties, and it was opened in 1890.

The Rosetta and Damietta arms of the Nile delta are crossed by it, the former crossing having a length of 525 feet and the latter of 1765 feet; the center resting on the point between the two arms. The spans are 16 feet 6 inches in the clear, while the piers are 6 feet 6 inches thick. Irrigating canals start from the extremities.

The towers for operating the draws over the canals, and the smaller towers for operating the gates, add to its picturesqueness and make it a striking piece of architecture.

Towers and triumphal arches have been used in many instances to give an architectural effect to masonry bridges. The bridge of St. Chamas, built by the Emperor Augustus, was noted for the triumphal arches at either end, which were among the remarkable pieces of Roman architecture.

"F."

*Subject of Frontispiece.

PRACTICAL STONE-CUTTING.—VII.

"Ramp and Twist," or the practical application of the science of Handrailing in the construction of Bed Moulds, Joint Patterns, Templates, etc., as required in order to work all forms of Twisted Coping at Circular Walls; Handrails and Strings for Circular Stairs, and work of a similar form comprised chiefly of Twisted Surfaces.

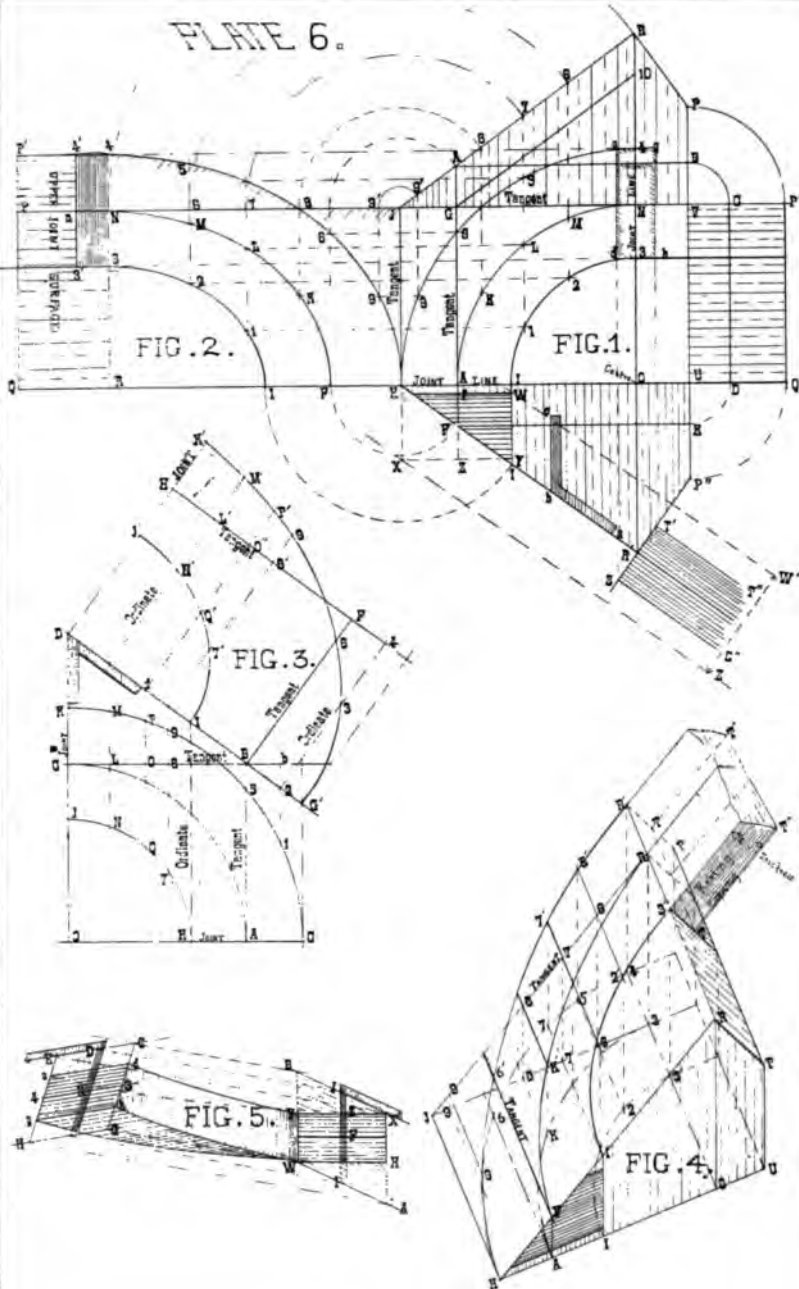
INSTRUCTIONS FOR FORMING A CARDBOARD REPRESENTATION OF A SOLID, SHOWING THE DEVELOPMENT AND ACTUAL POSITION OF THE BED, AND JOINT PATTERNS, OR SECTIONS; AT A PIECE OF COPING (OR RAIL) THE PLAN OF WHICH IS A QUARTER CIRCLE; THE FULL INCLINATION OF THE SECTION PLANE PLACED OVER ONE TANGENT, THE OTHER BEING LEVEL.



IN Fig. 1 is shown the plan, O being the center with which the outer curve H—6—4; center A—L—N; and inside face curve 1—2—3, are drawn. These may of course be drawn with any convenient radius to suit the size of cardboard. Having drawn the curves, draw the Tangents A—G, and G—N to the points A—N of the center curve, and produce them. Then parallel with the Tangents through A and O, draw lines indefinitely. Now determine upon the inclination of the Oblique section plane, and set off its rise as shown in N—10; join G with 10; then through H parallel with A—G, draw H—J; then through J, parallel with G—10, draw J—R; then square with J—R, draw R—P of any desired length. Then through P parallel with R—O draw P—P' indefinitely, meeting the Tangent produced in V; this gives in V—J—R—P—V, the representation of the Tangent plane over G—N of the solid. Now as shown on H—U, construct a similar and equal figure to that on J—V. This will be another side of the solid. The third side may be formed by making U—Q, equal to U—P', and through Q draw Q—P'. This completes the sides of the model.

Now to construct the representation of the Section plane, and develop section: FIRST—Through any points on the plan curves as 1—K—9, etc., parallel with the level Tangent A—G, produce lines 9—9'; K—B; 1—L—5—7, etc., meeting the inclined line as shown in 9'—7—8—6, etc. Then with J as center rotate each point into 9'—8—7, etc., of the Tangent line produced; also rotate F—I, into F—I, of the section plane Fig. 2. Now square with J—N, through 9'—8—7, etc., produce lines, 9'—9, etc.

PLATE 6.



Then parallel with V—N from the points 1—K—9, etc., of the plan curves, produce lines, these intersect the level ordinates of the section plane, as shown in the points 1—K—9, etc., giving the points through which to trace the elliptical curves of the Bed Mould. In practical work, the best way is to put in wire nails at the points 1—2—3, etc., then bend a flexible strip around them, in this way the curve may readily be drawn. Of course the greater the number of points made use of, the more accurate may the elliptical curves be drawn. Now having drawn the curves; set off R—Q, and 4—P', equal to P—P, Fig. 1, and draw P—Q. Then set off F—f, and N—n; equal to the half thickness of the coping, and complete the half sections of the coping as shown in the shaded drawing, which will complete the model.

Now take a sharp knife and cut clear through the board at the outline of the drawing, following the curve line at 4—5—8. Then at the lines J—H; J—V, V—U; U—H, cut about half through the board, touch the edges with liquid glue, and bring them together, leaving all lines on the exterior, so that their connections may be clearly seen and understood. If now two pieces of paper are cut to the full size of the joint section, and fastened at their proper position at the joint surfaces, it will be clearly seen that the plan of the joint over A is simply the line H—I; but, owing to the inclination of the joint surface over N, the plan of joint, occupies a space as shown comprised within d—e—g—h. The patterns will also show the manner in which the top and under surfaces "Twist" in going around the curved plan. If a parallel W—W' be drawn, through the point W, of the lower joint section, the half thickness of the rough stone out of which to form the coping will be given. The full thickness of stone is shown in W'—Z, and as may be noted, the rough stones are in a manner intersected with a central plane H—R', and it is on this plane that the bed moulds are developed.

It is our intention at drawings which follow later, to show that in the majority of problems, the section planes of the bed moulds as projected by the Tangent System, are not the most favorable ones as regards the quantity of material required out of which to form the stones. In some cases an excess of nearly one-third is required over that of the Falling Line System; this great quantity of material being wasted, in order to have the joint surfaces square with the working, or cutting plane. The student will please notice, if the drawings are made and folded together correctly, that the joint surfaces are at right angles with the oblique section plane of the bed mould, and are also square with the Tangents H—J, J—N, on its surface.

In Fig. 3 is shown the practical method by means of which the bed mould may be developed in actual practice. G represents the center; H—J

the inside, A—C the center, and G—K the outer face curves of the plan. A—B—C are the tangents to the points A—C at which the joints are desired. C—D shows the vertical rise of coping in going around the curved plan; joining D with B, gives the true inclination of the section plane. Divide the plan curves into any number of parts, and draw the parallels A—B from each point to meet the inclined line. Then square over lines as shown. Then set off D—E; B—F; equal to A—B, of the plan. Join E—F, and the Raking Tangent of the bed mould may be obtained. Then set off K'—E—J; M'—L'—N', 4—3' etc., equal to the length of the corresponding plan ordinates; and the points may be obtained through which to trace the curve. The bevel required at the lower joint surface, in order to give the direction of a plumb line, is shown in K—D—d. In Fig. 4, an oblique projection of the model is presented. In Fig. 5 is shown the Geometrical elevation of a piece of coping, together with the bevels applied to the joint surfaces, etc. The top working surface of the rough stone is shown in X—B—C—E. This meets the lower joint section at the point X; at the upper joint surface it does not meet the section, being raised above it, as shown in e—E, d—C. The same remarks apply to the lower working plane represented in A—W—G—H.

Charles H. Fox.

NATAL'S MARBLE QUARRIES.

FOR some time there was very promising talk regarding the marble quarries in Natal and the possibilities therein existing of building up a big business in this line and the consequent abandonment of the imports of Carrara marble from Italy. However, the quarries have not been worked and are lying dormant. Recent inquiry in the subject has brought to light the fact that the marble is not of good quality as was claimed for it at first. It was said that it was equal in quality, if not superior to the Carrara marble, but this has been disproved. The cost of labor for quarrying and the charges for transportation from the quarries to Durban, the distributing point, are both excessive, in fact prohibitive. The Italian marble can be quarried, shipped and delivered in Natal at lower prices than must be asked for Natal marble, in order to pay expenses. Persons most deeply interested in the rapid development of South African wealth are anxious that a prohibitive tariff be imposed on foreign marble, and that the native marble should be carried by railroads at nominal prices, in order to encourage the industry and put it on a sufficiently firm footing to eventually compete with the foreign product. These are merely suggestive, however, and no move is being made to bring about these measures. In the meantime building operations are proceeding briskly and foreign marbles are imported to a rather large extent.—Consular Report.

PUEBLO MASONRY.*



HE ancient pueblo builder, like his modern successor, was so closely in touch with nature, so dependent on his immediate physical surroundings, that variations in some at least of his arts are more natural and to be expected than uniformity. Especially is this true of the art of construction, and variations in masonry are more often than not the result of variations in the material employed, which is nearly always that most convenient to hand. Yet there were other conditions that necessarily influenced it, such, for example, as the character of the structure to be erected, whether permanent or temporary.

The highest type of masonry in the pueblo system of architecture consists of small blocks of stone of nearly uniform size, dressed, and laid in courses, and rubbed down in situ. No attempt was made to break joints. This system requires the careful preparation of the material before hand. As a variant we have walls composed of stones of fairly uniform size, laid with the best face out and with the interstices chinked with small spalls. Chinking is carried to such an extent in some places that the walls present the effect of a mosaic composed of small spalls. Chinking is almost a universal practice, and in some localities had passed, or was passing, from a mere constructive to a real decorative feature. Here we have the beginning of that architecture which has been defined by Ferguson as "ornamental and ornamented construction"—in other words, of architecture as an art rather than as a craft.

The use of an exterior finish of plaster was conducive to poor masonry. Such plastering is found throughout the region, but it is much more abundant in the modern than in the ancient work. Perhaps we may find in this a suggestion of relative age; not in the use of plastering, but in its prevalence.

Pueblo masonry is composed of very small units, and the results obtained testifying to the patience and industry of the builders rather than to their knowledge and skill. In fact, their knowledge of construction was far more limited than would at first sight be supposed. The marked tabular character of the stone used rendered but a small amount of preparation necessary for even the best masonry. For over 90 per cent. of it there was no preparation other than the selection of material. The walls and buildings

*Cosmos Mindeleff, in the Sixteenth Annual Report of the Bureau of American Ethnology.

were always modified to suit the ground, never the reverse, and instances in which the site was prepared are very rare, if not indeed unknown.

Chinking was sometimes done, not with slips of stone driven in with a hammer, after the usual style, but with bits of mud pressed in with the fingers. The mud was used when about the consistency of modeling clay, and bears the imprints of the fingers that applied it; even the skin markings show clearly and distinctly. From this use of mud to its use as an exterior plaster there is but a short step. In plastered walls the process was carried a step farther, and the surface was finished by the application of a final coat of mud made quite liquid. The interior plastering of kivas was always much more carefully done than that of any other walls. Owing to blackening by smoke and recoating, the thickness of the plastering in kivas can easily be made out. Often it is as thin as ordinary paper.

It seems probable that the application of plaster as a finish grew out of the use of stone spalls for chinking, and its prevalence in modern as compared with old structures is suggestive. Surface finishing in mud plaster is the prevailing method at the present day, and well-executed masonry of stone carefully chinked is almost invariably ancient. The use of surface plaster is largely responsible for the deterioration of stonework that has taken place since the beginning of the historic period. The modern village of Zuñi, which dates from the beginning of the eighteenth century, although built on the site of an older village, is essentially a stone-built village, though that fact would never appear from a cursory examination, so completely is the stonework covered by surface plaster.

In Tusayan (Moki) walls have been observed in progress of erection. The stones were laid up dry, and some time after, when the rains came and pools of water stood here and there in pockets on the mesa top, mud mortar was mixed and the interstices were filled. This method saved the transportation of water from the wells below up to the top of the mesa, a task entailing much labor.

It is probable that the practice of chinking grew up out of the scarcity of water, when walls were erected during the dry season and finished when the rains made the manufacture of mud mortar less of a task. Chinking, both with mud and with spalls, was extensively practiced.

Although walls were often built on sloping rock, and the builders had experience and at times disastrous experience to guide them, the necessity for a flat and solid foundation was never appreciated. Walls were sometimes built on loose debris; even refuse which had been covered and formed an artificial soil was considered sufficient.

It is well known that sheep were introduced into this country by the Spaniards, and the presence in the ruins of sheep dung, or of a material closely resembles it, is important. Much of this is due to subsequent

Navaho occupancy, and many ruins are used to-day by these Indians as sheepfolds. It is said, moreover, that at the time of the Navaho war, when the soldiers bayoneted all the sheep they could find, large flocks were driven up into some cliff ruins that are almost inaccessible, and kept there for a time in security. But many instances are found where the walls rest directly upon layers of compacted dung.

It has been suggested that the compacted dung found in the ruins was the product not of sheep, but of some other domesticated animal which existed in this country at the time of the first Spanish invasion, but the evidence to support this hypothesis is so very slight that so far the suggestion is only a suggestion. Not the slightest trace of this animal has been found, although it is alleged that it was domesticated among the pueblos three hundred and fifty years ago.

Although the idea of a strengthening or supporting buttress is thought to be a foreign introduction, a hypothesis that is strengthened by the occurrence of other features, the masonry itself is aboriginal in its principles and probably also in execution. The conservatism of the Indian mind in such matters is well known. The Zuni to-day use stone more than adobe, although for a hundred years or more there has been an adobe church in the midst of the village.

Adobe construction in this region is only partially successful. North of the Gila river, in the plateau country, the climate is not suited to it; the rains are too heavy and the frosts are destructive. Constant vigilance and prompt repairs are necessary, and even then the adobe work is not satisfactory. Certainly in the northern part of the country the aborigines would not have developed this method of construction in the face of the difficulties with which it is surrounded. The fact that the only previously known examples of adobe work occur in ruins which are known to have been inhabited subsequent to the Spanish conquest, such as the ruin of Awatobi, in Tusayan, is suggestive. Moreover, adobe construction in this region belongs to a late period; for the walls are almost always very thin, usually six or seven inches. The old type of massive walls, two or even three feet thick, are seldom or never found constructed of adobe, although such thickness is more necessary in this material than in stone.

There is another method of construction which, although not masonry should be noticed here. This is the equivalent of the Mexican "jacal" construction, and consists of series of poles or logs planted vertically in the ground, close to each other, and plastered with mud either outside, or on both sides. Dr. W. R. Birdsall mentions walls in the Mesa Verde ruins which are "continued upward upon a few tiers of stone by wickerwork heavily plastered inside and outside"* and Nordenskiöld mentions a similar construction in the interior of a kiva.

*Bull. Am. Geog. Soc., vol. xxiii, p. 598.

STONE BLOCK STREET PAVEMENTS.

THE use of stone for street pavements has not kept pace with the development of street improvements for several reasons. Stone block and cobble pavements were for many years the only hard pavements with any pretensions to durability. They were laid on the soil found in place, with scarcely any preparation or compacting other than the formation of a smooth surface and the application of a bed of sand. The spaces between the blocks were filled with sand or tar and gravel. Little attention was paid to strict uniformity of size of blocks and width of courses. As a consequence the pavement was unnecessarily rough when new, and unequal settlement occurred on account of lack of uniformity in the compactness of the subsoil and lack of sufficient protection thereof from the effects of surface water, so that the condition of many pavements was soon very bad. The rate of wear of the blocks was greatly increased by these inequalities in surface from both causes.

City officials looked for more satisfactory materials and found those that would make smoother pavements in asphalt, brick and wood. They found these to be less durable materials, which were found to demand solid foundations, and to find their best conditions only when a monolithic concrete foundation is used. Unless a cheap pavement intended for a street with little traffic is desired, any of these materials are failures without such foundations.

If now the good foundation is applied to the stone block pavements, and at the same time more care is taken in selecting blocks of uniform size for a row, we will secure pavements which, except under the very heaviest traffic and in some special cases, are almost indestructible. Such pavements have a high first cost, but their great durability makes them the cheapest in the end. Most tables of cost of repair of stone block pavements are made up for those without concrete foundation, so that there is a material reduction in the stated life of such pavements from that possible when the blocks are properly laid on a concrete foundation. Such pavements have a large field of usefulness, and if contractors will insist upon the added expense of the concrete, selection of blocks for width and uniform depth, and proper filling of joints, they will do the cities they serve a good turn and eventually benefit the producers of such materials and themselves.

A good specification for a stone block pavement should require thorough preparation of the sub-grade by removing soft and spongy materials, and

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thoroughly rolling with a heavy roller, say of twelve or fifteen tons weight. On this should be placed a layer of first-class cement concrete about six inches thick, which should be brought to a smooth surface. When this concrete is strongly set, cover it with a layer of sand two inches in thickness. With the variation in depth of blocks allowed by some specifications a greater thickness may be necessary. The best results are obtained with blocks having a very slight variation. The nearer they approach the uniformity of bricks the better. The greater the uniformity in depth the greater the cost of the blocks and a specification must take into account this fact, and the depth of pocket of the municipality, as well as the desirability of uniformity. It is not very difficult to select blocks of the same width, within a small margin, to be laid in the same row, and this should be required. Uniform width of joints and straight rows add much to the smooth riding of the pavement. The blocks should be laid by an expert who will leave the proper amount of sand under each block, so that when the pavement is thoroughly rammed they will all be in solid bearing and conform strictly to the true surface of the street. The joints should be filled with fine gravel and sand and tar or cement mortar.

Such a pavement will be the smoothest possible, and will retain its position without settlement. Inequalities due to defects in foundation will not appear to increase the wear on the blocks, and, unless the traffic is very heavy or must follow narrow lines, so that ruts are formed, the life of the pavement will be long—much longer than one of any other material in use, and will retain its original surface most nearly. Cities which have used this specification testify to the increased value of stone pavements on this account.

Stone pavements are not now used on residence streets nor on business streets with traffic in light vehicles, but are indispensable in districts with heavy traffic. Their field can be extended somewhat by insisting upon strong specifications, thus improving the surface offered by the block pavement and removing a large part of the roughness, which is the prominent objection to stone pavements.

Charles Carroll Brown.

M. Am. Soc. C. E., Consulting Engr.

USEFUL INFORMATION FOR ALL IN THE STONE TRADE.

A LINE is that which has only length. A surface is that which has only length and breadth. A solid is that which has length, breadth and height, or depth. The faces of a solid are its bounding surfaces. Weight is the measure of the quantity of matter in a body determined by the force of which it is naturally drawn towards the earth. A unit of measure is some quantity used as a standard of comparison in measuring a quantity of the

same kind. Linear measurement is used in estimating distances and the length of articles. Surface or square measure is used in estimating surfaces. Solid or cubic measure is used in measuring bodies, or things having length, breadth, and height or depth. The area of a figure is its quantity of surface. An angle is the difference in direction of two straight lines which meet at a point. A square is a surface having four equal sides and four equal angles. A rectangle is any surface having four sides and four equal angles. The contents of a solid are the number of times it contains a given unit of measure. A cube is a body bounded by six sides or faces. A rectangular solid is a cube bounded by rectangular faces. Circular measure is used for measuring angles, latitude and longitude, difference of direction, etc. A circle is a plane figure, bounded by a curved line, all the points of which are equally distant from a point within called the center. The circumference of a circle is its entire boundary line. The arc of a circle is any part of the circumference. A diameter of a circle is any straight line drawn through the center and terminated by the circumference. The circumference of every circle, whatever, is supposed to be divided into 360 equal parts called degrees. A quadrant is a fourth of a circumference. A circumference of any circle has 21,600 minutes, or 1,296,000 seconds. Twelve inches equal one foot. Three feet one yard. Five and a half yards or $16\frac{1}{2}$ feet one rod, pole or perch. Four rods one chain. Ten chains or 40 rods one furlong. Eight furlongs or 320 rods or 5,280 feet one mile. Three miles one league. Seventy geographic miles one degree. A mile is 1,760 yards. A cubit is two feet. A hand is four inches. A palm is three inches. A space is three feet. A span is $10\frac{3}{8}$ inches. One hundred and forty-four square inches equal one square foot. Nine square feet one square yard. Thirty and one-fourth square yards one square rod, pole or perch. Forty square rods one square rood. Four square roods one square acre or 43,560 feet. One hundred and sixty square rods or perches one acre. Six hundred and forty square acres one square mile. An acre contains 4,840 square yards. Two hundred and nine feet long by 209 feet broad is one acre. One thousand, seven hundred and twenty-eight cubic inches equal one cubic foot. Twenty-seven cubic feet one cubic yard. One hundred and twenty-eight cubic feet one cord; 24.75 cubic feet one perch. A pile 8 feet long, 4 feet wide by 4 feet high is a cord; a cord foot is one foot in length of the pile or 16 cubic feet. A solid yard or 27 solid feet is equal to 46,656 solid inches. Sixty seconds equal one minute. Sixty minutes one degree. Three hundred and sixty degrees one circumference. One average cubic foot of marble weighs 161 pounds avoirdupois. One average cubic foot of granite weighs 165 pounds avoirdupois. A bushel of unslacked lime weighs 80 pounds.

MANAGEMENT OF QUICKSANDS IN FOUNDATIONS.

TWENTY-FIVE years ago, anticipating that I would probably have to contend with quicksand in my work, I read up on the subject everything that I could find, but with very little satisfaction. In fact the theories set forth by the majority of writers on the subject were virtually of no use when I met with the actual facts in the course of my experience. I investigated the matter very thoroughly, however, finding a very essential point in the fact that in all quicksands a great variety exists in the sizes of the atoms, this variation requiring various plans to be tried to successfully contend with the difficulties that must be overcome.

I did not have long to wait before meeting with a quicksand bottom. I was then engaged on the foundations of the bridge work of the D. L. & W. Railroad, in Hoboken. In foundation east of Henderson street we had to go two feet into a bed of quicksand to get our depth. In this case it happened that I had a large bank of oyster shells in the way, which I utilized. I cribbed my sump large enough to give me plenty of room, mixed the oyster shells with gravel, and put a bed of the mixture all around the sump, shoveling the sand out of the middle and allowing the mixture to sink until I got below the required depth; the mixture closing in and making a solid bottom for sump. After this I uncovered about ten feet square section of the sand, throwing out the sand as quickly as possible with as many men as could conveniently handle a shovel. The moment the required depth was reached we covered the bottom with a foot of the gravel and shells. When this was done and walked over, it would all be in a movement, but after standing a few hours it would become perfectly solid. The cause of its becoming solid is that the larger atoms of the sand passing up through the mixture adhere to the shells, gradually closing up all the crevices. Leading drains across the foundation we successfully completed the work. After this I used crushed stone with better results than with the gravel.

Some years later when superintending the construction of a large tank—200 feet in diameter—for gas holder in Brooklyn, at thirty feet in depth—just the depth we had to go—we uncovered a quicksand bed. The contractor was very much excited, having previously lost several thousand dollars in a similar case. I proceeded this time with crushed stone in getting my sump down, sinking a wall of broken stone all around the well hole, got our pipes into their proper depth and made this our sump, leading box drains from this point all over the bottom, uncovering sections of ten feet square and replacing with crushed stone a foot thick, completing the whole bottom on this system with entire success.

J. B. Gordon.

MINERAL PRODUCTION OF THE UNITED STATES IN 1897-8.

(PRELIMINARY STATEMENT.)

Compiled for THE MINERAL INDUSTRY, Vol. VI.

By Richard P. Rothwell, editor of the *Engineering and Mining Journal*.

Number.	Products.	Customary Measures.	1896.				1897.			
			Quantity.		Value at Place of Production.		Quantity.		Value at Place of Production.	
			Customary Measures.	Metric Tons.	Totals.	Per M. Ton.	Customary Measures.	Metric Tons.	Totals.	Per M. Ton.
NON-METALLIC.										
Abrasive:										
1	Carborundum.....	Sh. T.	598	589	\$985,612	\$20.08	621	568	\$158,812	\$20.27
2	Corundum.....	Sh. T.	250	227	35,000	154.19	290	209	32,200	154.07
3	Crushed steel.....	Sh. T.	336	296	50,684	171.00	324	294	51,424	176.00
4	Diatom. earth.....	Sh. T.	3,540	3,211	34,200	10.65	3,000	2,721	30,400	11.17
5	Emery.....	Sh. T.	1,550	1,406	108,500	77.17	1,500	1,361	105,000	77.15
6	Garnet.....	Sh. T.	2,440	2,214	86,400	38.57	2,260	2,060	79,100	39.57
7	Grindstones.....	Sh. T.	31,301	28,396	294,398	10.36	36,031	33,250	306,675	11.00
8	Pumice.....	Sh. T.	Nil.	Nil.	Nil.	Nil.	1,700	1,542	8,500	5.51
9	Quartz crystal.....	Sh. T.	6,000	5,432	16,500	3.04	6,000	5,432	16,500	3.04
10	Tripoli.....	Sh. T.	1,405	1,275	4,820	3.79	1,031	1,479	5,475	3.70
Whetstones.										
11	Alum.....	Sh. T.	14,000	12,782	422,700	33.07	15,456	14,021	468,000	33.07
12	Aluminum sulphate.....	Sh. T.	42,240	38,819	1,056,000	27.56	46,355	42,053	1,158,876	27.56
13	Ammonium sulphate.....	Sh. T.	257	228	10,240	4.82	3,111	2,822	124,440	4.82
14	Asbestos.....	Sh. T.	710	650	12,670	19.49	770	698	15,400	22.06
15	Asphalt.....	Sh. T.	20,414	18,519	362,500	10.58	27,397	24,854	490,020	19.58
16	Asphaltic limestone.....	Sh. T.	5,000	4,536	55,000	12.12	2,300	2,108	11,450	5.39
17	Bitumin. sandstone.....	Sh. T.	51,936	47,134	132,500	2.81	41,185	37,963	125,555	3.86
18	Barytes.....	Sh. T.	21,900	19,987	87,600	4.41	27,310	24,781	109,264	4.41
19	Bauxite.....	L. T.	17,000	15,369	42,740	2.46	20,500	20,910	41,180	1.97
20	Borax (crude).....	Sh. T.	18,320	12,084	266,400	22.04	19,400	17,500	398,000	22.05
21	Bromine.....	Lb.	559,265	253	143,074	70.57	487,149	221	136,402	70.69
22	Calcium carbide.....	Sh. T.	890	780	48,000	61.54	1,025	1,746	184,750	17.17
23	Cement, nat. hydrant.....	Bbls	7,407,311	1,007,981	4,385,962	4.35	7,781,377	1,059,888	4,127,124	8.90
24	Cement, Portland.....	Bbls	1,577,389	246,181	2,502,470	8.74	2,272,971	412,405	3,578,830	9.45
25	Cement, slag.....	Bbls	Nil.	Nil.	Nil.	Nil.	40,000	6,850	60,000	9.45
26	Chrome ore.....	L. T.	702	713	7,775	10.90	50	51	550	10.78
27	Clay products.....	Sh. T.	Nil.	Nil.	65,000,000	Nil.	Nil.	Nil.	600,000,000	Nil.
28	Coal, anthracite.....	Sh. T.	48,138,080	42,067,101	81,082,740	2.08	52,645,138	47,750,695	85,867,717	1.79
29	Coal, bituminous.....	Sh. T.	139,468,650	126,525,967	113,401,602	0.80	147,587,509	133,984,600	120,505,962	0.80
30	Coal, cannel.....	Sh. T.	54,061	49,548	146,491	2.95	56,511	51,267	153,145	2.98
31	Coke.....	Sh. T.	10,369,015	9,406,770	17,811,823	1.84	12,742,340	11,569,673	23,367,870	2.08
32	Cobalt oxide.....	Lb.	12,825	5,817	17,314	2.98	10,300	38,754	32,810	3.75
33	Copperas.....	Sh. T.	11,170	10,133	52,662	5.19	11,924	10,818	56,565	5.23
34	Copper sulphate.....	Lb.	48,732,840	22,150	1,053,225	88.18	51,012,945	23,139	2,040,518	5.36
35	Fluorspar.....	L. T.	24,007	25,305	124,251	4.91	20,900	21,234	113,773	5.36
36	Feldspar.....	Sh. T.	6,000	5,432	48,000	8.83	9,025	8,187	74,458	9.09
37	Fullers earth.....	Sh. T.	11,826	10,275	68,476	6.66	17,049	15,467	91,634	5.98
38	Grahamite (c).....	Sh. T.	1,262	1,163	38,460	33.07	1,756	1,592	52,690	33.09
39	Graphite, crystalline.....	Lb.	405,000	189,700	18,225	2.10	903,138	345,487	44,091	7.10
40	Graphite, amorphous.....	Sh. T.	574	520	3,850	7.40	1,200	1,090	11,400	10.45
41	Gypsum.....	Sh. T.	106,553	177,405	583,136	3.29	223,001	202,300	711,952	3.52
42	Iron ore.....	L. T.	16,000,056	16,256,057	31,200,880	1.93	18,816,967	18,610,038	31,138,844	1.67
43	Litharge.....	Sh. T.	6,500	5,807	540,300	91.57	9,000	8,081	609,100	100.11
44	Magnesite.....	Sh. T.	2,067	1,875	9,715	5.12	1,907	1,730	7,028	4.41
45	Manganese ore.....	L. T.	162,526	165,126	330,089	2.05	156,787	159,396	332,700	2.09
46	Mica, ground.....	Sh. T.	570	517	9,687	18.73	2,692	2,442	38,218	15.65
47	Mica, sheet.....	Lb.	17,630	77,997	12,529	71.57	92,335	341,883	45,615	71.09
48	Mineral wool.....	Sh. T.	5,853	5,309	61,614	11.60	5,607	5,141	45,494	8.81
49	Monazite.....	Lb.	17,500	8	875	109.37	40,000	18	2,000	111.11
50	Natural gas.....	Sh. T.	81,805	28,908	842,167	11.15	36,203	32,925	870,594	11.96
51	Paints, metallic.....	Sh. T.	17,835	16,179	178,733	11.05	11,151	10,110	110,165	10.89
52	Paints, ochre, etc.....	Sh. T.	5,908	5,300	53,590	17.02	4,506	4,169	55,690	10.96
53	Paints, venetian red.....	Sh. T.	65,655	67,049	7,868,310	90.39	108,235	98,054	9,201,150	99.21
54	Paints, white, red l d.....	Sh. T.	15,863	14,391	1,190,725	82.67	26,262	23,825	2,100,960	83.18
55	Petroleum (crude).....	Bbls	55,254,735	7,730,425	65,753,206	8.50	56,985,643	7,972,579	44,804,982	5.69
56	Phosphate rock.....	L. T.	937,372	852,370	2,812,116	2.95	906,080	820,577	2,718,240	2.95
57	Phosphoric acid.....	Sh. T.	Nil.	Nil.	200,000	Nil.	Nil.	Nil.	101,000	Nil.
58	Pyrites.....	L. T.	100,262	111,080	202,626	2.63	128,468	130,523	379,690	2.88
59	Salt.....	Bbls	15,707,008	1,005,017	5,328,250	2.67	13,153,524	1,670,592	4,859,364	2.91
60	Silica, sand & quartz.....	L. T.	720,300	731,325	1,070,088	1.47	750,000	762,000	1,125,000	1.48
61	Slate, roofing.....	Sq. ft.	600,100	467,578	2,390,862	3.23	805,372	647,045	2,685,590	3.01
62	Slate, manufactures.....	Sh. T.	14,850	13,018	143,500	11.02	18,974	17,213	189,740	10.91
63	Soda, natural.....	Sh. T.	3,000	2,722	65,000	23.88	5,000	4,536	110,000	24.25
64	Soda, manufactured.....	M. T.	Nil.	157,475	4,621,325	29.00	Nil.	277,072	5,774,656	20.84
65	Stone for building.....	Sh. T.	Nil.	Nil.	30,500,804	Nil.	Nil.	Nil.	30,000,000	Nil.
66	Stone, limestone flux.....	L. T.	3,794,175	3,854,382	1,660,437	0.43	4,247,688	4,315,651	1,868,983	0.43
67	Sulphur.....	Sh. T.	Nil.	Nil.	72,200	18.70	1,600	1,717	34,814	20.27
68	Sulphuric acid.....	Sh. T.	1,019,501	924,885	17,381,517	18.74	1,128,741	1,023,987	21,416,079	19.19
69	Talc, common.....	Sh. T.	7,008	6,430	63,585	9.87	9,563	8,675	82,705	9.54
70	Talc, fibrous.....	Sh. T.	51,816	47,007	256,080	5.45	58,890	53,376	288,185	5.39
71	Uranium ore.....	Sh. T.	Nil.	Nil.	Nil.	Nil.	17	15	9,010	600.66
72	Zinc ore, exported.....	L. T.	2,324	2,361	47,408	20.08	9,251	9,399	211,350	22.48
73	Est. prod. unspecified.....	Sh. T.	Nil.	Nil.	5,000,000	Nil.	Nil.	Nil.	5,000,000	Nil.
Total non-metals.....					\$44,900,130				\$81,692,107	

METALS.									
78 Aluminum.....	Lb.	1,300,000	589,676	\$520,000	580.85	4,000,000	j1,814,400	\$1,400,000	580.77
79 Antimony.....	Lb.	1,325,000	556	84,717	152.37	1,500,000	690	107,250	157.72
80 Copper (m).....	Lb.	479,406,188	217,639	51,003,397	234.35	510,190,719	231,421	56,325,055	243.39
81 Gold.....	Oz. f	2,558,48	779,576	52,886,249	664.60	2,864,576	789,092	59,210,795	664.66
82 Iron, pig.....	L. T.	8,023,127	8,701,097	91,577,610	10.45	9,652,640	9,807,123	92,677,312	9.45
83 Iridium.....	Oz.				20.25			606	
84 Lead, value at N. Y.	Sh. T.	174,792	158,479	10,411,649	54.07	197,718	179,368	11,784,093	65.73
85 Nickel.....	Lb.	17,170	7,788	4,464	70.57	33,700	15,286	11,698	70.76
86 Platinum.....	Oz. f	200	6.21	2,800	450.80	200	6.21	3,000	482.39
87 Quicksilver.....	Flksq	20,863	1,030	1,104,997	1066.58	26,679	965	901,008	1026.94
88 Silver, comm'l value	Oz. f	58,488,810	j1,819,208	39,245,902	731.58	56,457,292	j1,756,004	33,755,815	19.23
89 Zinc.....	Sh. T.	77,037	70,432	6,117,706	86.80	100,387	91,070	8,271,889	90.83
Total metals.....				252,050,625				264,538,485	
Grand totals.....				727,958,781				746,230,982	

(a) Barrels of 300 lb.; (b) 400 lb.; (c) 200 lb.; (d) 42 gal.; (e) 280 lb. (f) Troy ounces. (g) Flasks of 75½ lb. (h) Bituminous coal includes brown coal and lignite. The anthracite production is the total for Pennsylvania, Arkansas, and Colorado. (i) Estimated. (j) Kilograms or per kilogram. (k) Including bitumen from Texas. (m) The value of the copper production is calculated at 0.25c. per lb. less than the average price of Lake copper at New York. (n) Value per square. (p) Value per cubic foot. (q) This figure is only approximate and will be revised.

Abbreviations: Sh. T., short tons (2,000 lb.); L. T., long tons (2,240 lb.); M. T., metric tons (2204.6 lb.); Sq's, squares (100 sq. ft., lapped and laid).

Small Stones in Masonry.

The ancients could not draw stones of any considerable size from the quarries, says an English exchange. They made good use of the small broken bits of stone they could dig out, but our mechanical advantages enable us, with larger blocks, to adopt a more perfect kind of masonry. There is no doubt that some of the finest buildings of antiquity are constructed of stones of immense size. The Pantheon may be quoted, and every one will remember the huge blocks that must have been quarried for monolith columns. The general decline of art shows itself in this respect, perhaps, as well as others. There is a great gap between such a building as the Porta Nigra, of Trèves, and the best of early Romanesque masonry. Art in all its branches was, it seems, almost to die, in order perhaps that Christian art might be less a development than a new creation. The Pharos in Dover Castle is a fine specimen of Roman excellence. Its builders could not get hewn stone; but they so bound their flint rubble with bands of brick that the tower stands like a rock.

Close by, in the church, is a good deal of undoubted British masonry in its shell. Here, too, there is "Roman brick" in the quoins, etc.; but the general inferiority of the masonry to the real Roman work is very striking. Then

again the fine Romanesque ashlar in the chapel of the Norman is a specimen of the reviving art of masonry. The stones are all small, though beautifully and effectively used. There is no single stone to tempt you to measure its length and width, and to exclaim at its bulk, which seems to be the general effect produced on people's minds by modern masonry. As a matter of fact, it must, we suppose, be granted that the architects of the Romanesque and Early Pointed Styles could not procure large stones. They were compelled to use even fine building stone, like that (which they so highly valued) of Normandy, in small masses, as they could inartificially obtain it from the quarries. So late as 1841, there was not a single crane at Caen by which to lift the stone had it been extracted in very large blocks—a fact that may assist us to comprehend the great mechanical disadvantages under which the Mediæval architects labored. But though their stone was in such small pieces, how beautifully they used it. Of course there is a great deal of ancient work that is very bad, although what has stood for six or seven centuries may seem fairly entitled to entire exemption from any blame. But as a general rule early masonry—at least, after the later Romanesque had superseded the Anglo-Saxon kind—is surprisingly excellent, not only for solidity, but for keeping and harmony. It suits the style. The eye is satisfied en-

tirely, without knowing or inquiring why. You admire the design, and feel almost unconsciously that it is worthily embodied in its material exhibition. You are admire the design, and feel almost unconsciously that it is worthily embodied in its material exhibition. You are neither induced to examine and commend

the ingenuity with which the difficulties of a bad building stone are overcome, nor are you called on to join in the vulgar admiration of "such big blocks." In a word, you forget such a detail in the whole; but when you can descend from the whole into particulars, you find them all that can be wished.

OUR FOREIGN TRADE IN STONES, ETC.

From the monthly summary of finance and commerce of the United States, corrected to June 1, 1898, we compile the following:

ARTICLES.	APRIL.				TEN MONTHS ENDING APRIL—			
	1897		1898		1897		1898	
	Quan.	Values.	Quan.	Values.	Quan.	Values.	Quan.	Values.
Imports—		Dollars		Dollars		Dollars		Dollars.
Cement (lbs., :								
Imp. from—								
United Kingdom.....	11,431,335	35,705	2,727,406	8,990	160,696,139	522,143	108,443,495	361,753
Belgium.....	13,052,609	88,030	19,687,138	57,415	207,716,543	603,993	192,093,417	578,780
France.....	152,700	1,081	606,300	2,168	9,509,388	27,275	14,317,316	36,076
Germany.....	46,926,981	151,341	30,954,732	102,673	348,480,136	1,143,682	329,170,967	1,105,137
Other Europe.....	1,811,554	7,371	892,800	3,926	9,526,201	36,196	17,442,181	54,423
British North America	30,400	132	187,500	900	2,125,300	8,500	1,461,749	7,107
Other countries.....					509,011	3,872		
Total.....	73,505,579	233,660	55,054,876	176,092	738,855,718	2,344,561	660,959,015	2,143,276
Marble, and mfrs. of		118,390		67,066		694,483		567,924
Stone, & manufactures								
of, including slate.....		84,039		23,414		769,243		207,639
Total.....		137,429		90,480		963,726		775,766
Exports—								
Marble and stone, and								
manufactures of:								
Unmanufactured.....		5,852		6,714		59,005		83,531
Manufactures of—								
Roofing slate.....		91,986		97,863		577,184		1,100,874
All other.....		30,785		31,949		478,512		340,377
Total.....		137,623		136,519		1,109,701		1,524,782
Cement..... bbls	1,655	2,942	2,067	3,871	27,837	61,297	40,469	70,369
Lime.....	4,591	4,061	3,918	3,877	68,422	64,164	43,473	37,253
Exports foreign mfrs.								
Cement, Rom., Portland								
etc..... lbs	91,554	439	718,514	1,024	2,477,301	9,195	3,864,305	14,394
Marble, & mfrs. of.....		141				5,623		2,441
Stone, & mfrs. of includ-		1,594		201		10,037		1,735
ing slate.....								
Total.....		1,735		201		15,660		4,066

Merchandise Remaining in Warehouse on April 30, 1897, and 1898 Respectively.

ARTICLES.	April			
	1897		1898.	
	Quantities.	Values.	Quantities.	Values.
Cement, Roman, Portland, etc..... lbs...	7,210,192	\$ 20,203	3,476,713	\$ 9,146
Marble and stone, and manufactures of:				
Marble, and manufactures of.....		16,506		60,712
Stone, and manufactures of, including slate.....		1,509		9,097
Total.....		18,075		69,809

Exports from the United States to

ARTICLES.	QUANTITIES					VALUE.				
	1893.	1894	1895	1896	1897	1893	1894	1895	1896	1897
British Australasia:										
Marble and stone, and mfrs. of						\$208,260	\$246,150	\$260,628	\$464,818	\$697,654
Hawaiian Islands:										
Lime and Cement.....	15,092	16,303	15,365	19,409	26,825	18,913	16,826	15,386	17,923	22,490

b Lime only.

Concord Granite.

The Concord Commercial club has issued a handsome, valuable and interesting pamphlet devoted to Concord, New Hampshire, granite, and containing numerous views of buildings and monuments erected in various parts of the country from that granite.

The pamphlet says in introduction:

The aim of this book is to demonstrate to architects, builders, and monumental dealers the fact that Concord granite has been, and is now being used, in some of the finest buildings and monuments in the country, and to endeavor to remove any unjust prejudice against it which exist in the minds of some—such prejudice being caused by the interested actions of rivals and the short-sighted methods of some who have used inferior grades of Concord granite to its detriment as a whole, in the opinion of those who have only noticed the lower grades.

The hill from which most of the granite is quarried is known as "Rattlesnake hill," and is located about one mile from the state house. The hill is about three miles in length, and runs from north to south, the highest point being 580 feet above high-water mark of the Merrimack river. Granite has been quarried from this hill since the earliest days of the settlement of the town. The stone for the New Hampshire old state prison was quarried here in 1812, and for the New Hampshire state house in 1816-1819. The granite used in both these buildings was taken from boulders found on the surface, yet the state house is admirably preserved, with not the least sign of weathering or decomposition. Mr. B. Green who had charge of the erection of the congressional library in Washington, said the older portions of the state capitol was a fine example of Concord granite, considering the time it was quarried and the method of cutting granite in those days, and being taken from surface boulders.

From Rattlesnake hill has been quarried some of the finest granite in the world, making but little impression on it, as the quantity is inexhaustible, while the quality is such that it can be used for

all purposes for which granite is needed. An artesian well now being bored in the city through the solid granite, already between 1,300 and 1,400 feet deep, does not show any signs of reaching any other strata beneath the granite.

Concord granite is a muscovite-biotite granite, the essential constituents of which are quartz, orthoclase, muscovite and biotite; small crystals of apatite are nearly always present with more or less plagioclase. Government experts have indorsed it as a good and free stone to work, and it takes a high polish. The experts say, in regard to effect of weathering and decomposition on buildings in New York city, "in the finer grained granite from Concord, N. H., employed in the building on the corner of Twenty-third street and Sixth avenue, many of the blocks are set on edge, but the only change yet seen is that of discoloration by street dust and iron oxide from the elevated railway." This building was erected in 1870-1875. Professor W. C. Day, of the United States Geological Survey, when in Concord in the summer of 1897, said that "for hammered work, Concord granite cannot be excelled."

In the tests made of the various granites by Prof. H. A. Cutting, the specific gravity of Concord granite was 2.639; weight per cubic foot, 164.8; ratio of absorption, 1.778. In fire tests at 600 degrees Fahrenheit, it was uninjured; at 800 degrees it was slightly injured; at 900 degrees it cracked; at 1,000 it crumbled, and at higher degrees it was spoiled. In regard to fire tests of building materials, government experts say: "The fierce trials to which building materials of all kinds have been subjected in the great fires in Chicago and in Boston during the last decade, have shown that there are none, not even brick, which can withstand, in the form of thin walls, without warping or utter destruction, the tempest of flame evolved from the great magazines of combustibles gathered on every side in an American city."

For sculpture, it has been used on some of the finest statues; one of the oldest and most admired pieces of granite sculpture in the city of Boston, the Ether monument (or "Good Samaritan," as it

is usually called) in the Public Garden, is of Concord granite. Concord granite has been exported to Canada recently for statuary work.

For carving, Concord granite has no superior; its tenacity being such that the most delicate carving can be executed, fine samples of which can be seen on the Congressional Library at Washington, and other buildings.

For trimmings of brick buildings, Concord granite is unexcelled, its gray color forming a pleasing contrast to the dull appearance of the brick, and not having the glaring appearance of white marble, or the dead look of brownstone. Its appearance is restful and pleasing to the eye.

For building purposes Concord granite has been used in the finest buildings in the world, one of the most notable being the Congressional Library at Washington, D. C., which building is praised by all who view it.

For monumental purposes, the best quality of Concord granite has been admitted to meet the requirements of the most fastidious tastes. A notable example of its superior qualities is the monument now being erected in Galveston, Texas, Concord granite having been selected in preference to any other granite; and Texas produces some of the best granites in the country—of various tints.

For engineering purposes, bridges, etc., it has been extensively used in some of the best examples of engineering skill.

For street work, Concord granite fills the modern requirements for paving blocks, being hard enough to wear well, but not hard enough to become too slippery for horses to travel over. The objection made to some granites is their hardness, wearing smooth and becoming slippery; yet the opponents of granite paving are enthusiastic over asphalt. In foreign countries where asphalt has been tried they have become tired of the experiment and are returning to granite paving; and when the authorities of American cities have learned by experience the true value of granite for paving purposes Concord granite will be in demand for paving.

For commercial purposes, Concord granite has been divided into four grades: First—The best for sculpture, monumental and cemetery purposes. Second—The next best for general building work. Third—For underpinning, coping for walls, steps, and hitching posts. Fourth—For foundation stones, piers, abutments, and other purposes in which uniformity of color is not required.

Prior to the building of the Boston, Concord & Montreal railroad, granite and other freight was transported from Concord to Boston by teams, and the Concord & Boston Boating company. At the present day granite is forwarded by the Boston & Maine railroad, which company, since leasing the Concord & Montreal railroad has endeavored to place freight rates as low as possible and facilitate business. It has recently made a survey for a branch road up Rattlesnake hill to the different quarries, and when the road is completed, as no doubt it will be during the coming season, the advantage such a road will be to the granite trade cannot fail to be appreciated by shrewd business men, and those who are in search of a good location for the prosecution of large building and monumental enterprises will do well to look over the various inducements that Concord offers in unlimited supply of granite, water power, electric power and its foundries where necessary machinery can be readily manufactured. In addition to its attractiveness in a business way its scenery is unrivaled, its climate fine and healthy, its social attractions numerous and modern, and its citizens progressive.

The total shipment of granite from Concord by rail during the year 1896 was 30,869 tons, and in 1897, 22,012 tons. These were exceptionally dull years for the granite trade, 1897 being the lowest of any year on record.

Chicago's New Federal Building.

"More granite will be used in the construction of the new Government building than was ever employed in the construction of any other building in this country," said Henry Ives Cobb, the government architect.

"In the construction of the Congressional Library at Washington," continued Mr. Cobb, "350,000 cubic feet of granite were used. The quarrying of that amount took over three years, and over six years was occupied in the construction of the building. The Chicago Federal building will require 500,000 cubic feet of granite, and we hope to be able to get it out in a little over two years. The first lot is expected to arrive here about August 1 from the quarries at Mount Waldo, Me.

"Judging from the reports I have received the foundation work is well along and should be finished late in the summer. The contract calls for the superstructural work to be completed by January 1, 1902, and the contractor, Mr. Pierce, is confident he will be able to complete it within that time. The contract for the interior work, will probably not be let for a year.

It will take a great deal of time to apportion the space for the thirty or more departments which will be lodged there. There will be no delay, however, in pushing the interior work, which will be crowded along just as soon as the other work will permit."

Stone-Cutters Provide for their Fighting Men.

At a meeting of the Stone-Cutters' Society of New York, it was unanimously resolved to pay the wages of all members who enlisted and went to war.

The proposition is to pay to the family of every enlisted member the wages of his class for six days in the week. Some will receive \$4.50 a day, others \$4, and others \$3.50. It is felt that the organization is strong enough to keep this up indefinitely.

British Building Stones.

Stones, including granite, marble, porphyry, slate, and other varieties have been from all antiquity the leading material of monumental edifices, and except for decorative purposes, the stone of every locality has ever been employed

in its construction. We are apt to marvel at the wondrous golden splendor exhibited in the edifices of Attica by the use of marble; but, in truth, Mount Pentelicus was in a suburb of Athens, and its marble quarries the nearest at hand.

In other parts of Greece, stone, even of the coarsest grit, was used, and in the edifices on the banks of the Nile the quarries of the neighboring hills furnished the material, as the quarries of Mocattan for the core of the Pyramids of Ghizeh. The granite of Syene and alabaster was of rare structural application, and used almost exclusively for the monolithic statues, obelisks or sarcophagi. The general aspect of the city of Paris, where stone is the general material, and not the exceptional one as in London, has always been an object of envy to English architects. But even there the atmospheric influences act very much upon the stone, which becomes as dark as in London, a defect removed by periodical cleanings and scrapings. The small heights of the courses, especially in the frustra of the columns, as at the Madeline, are nevertheless very disfiguring to the principal buildings. Recently, however, they are able to overcome these defects, for, by means of the railway and a greater spirit of enterprise, distant quarries of a very superior quality of stone have been opened up to their architects, and their monumental edifices have gained immensely in structural character. We have stones of the finest qualities, whether of the limestone, magnesian limestone, or sandstone division. Our Bath oolitic is equal to that of Paris, if our miserable economy in some cases and the spirit of competition among unprincipled contractors, the stone merchants and quarrymen themselves, did not counteract the intention of the architect and bring into use the stone from inferior beds, instead of from the soundest and best strata. There is not a better stone than our sea girt Portland, if only properly selected, whether for its tone, its homogeneousness, or resistance to the atmosphere. St. Paul's Cathedral, thanks to the precautions of the illustrious Wren, and Somerset House, may

be cited to prove the enduring qualities of this material, when carefully chosen in the quarries. In these two buildings the arrises of the mouldings and angles and the very carvings retain their sharpness. Where the southwesterly rains wash the soot and smoke from the face, the surface is brilliant and the shadows sparkling. In such an atmosphere as that of a neighborhood where the acids of the manufactories, as in Lambeth, are poured forth broadcast from the furnace shafts, no stone can resist their corroding effects, and it is to this, and not to the quality of the stone, that the partial decay of some parts of the stone work of the Palace of Westminster is mainly due.—Stonemason.

Marble in Interior Work.

In forming designs with variously colored marbles, it is most essential to so arrange the materials as to produce agreeable decorative results. There are certain principles of color decoration recognized among artists who work with paint or distemper, and these principles should, as nearly as possible, be followed in dealing with the natural colors of marble. One of the first rules to be remembered is that the lightest colors should be applied to the largest apparent surfaces. We say apparent, because the surface of a panel may not exceed the united superficies of its stiles and ridges, but it should be lighter than these latter, because its surface is apparently larger, being seen in one mass.

No color in a decorative composition should appear isolated or strike attention on account of its singularity. To avoid this and to produce a generally harmonious effect the same color should be repeated; thus the general color of a dado may be repeated, although in smaller sizes, in other parts of the composition. The colors in the skirting should be repeated in the dado, capping, and again perhaps in the cornice, and in the case of a marble ceiling some of the color in it should be identical with some

of those in the wall paneling, although the latter may well be darker in its general tone. The darker and heavier colors should occupy the lower part of a composition, and the lighter colors the upper parts. Heavy colors of no very decided tone may very properly prevail in floors, to which they give the appearance of firmness and solidity; but it is necessary to be very careful in the matter, otherwise an effect may be given which will make a floor appear as if it were laid in ridges or upright cubes.

The primary colors, red, blue and yellow, are usually sparingly employed, blended tints being mostly applied to large surfaces. In marble the pure primary colors are not available in large sizes as their effects are subdued by means of veins and blended colors. It is easy, therefore, to avoid glaring effects, the difficulty being on the other hand to obtain any pure color at all. Pure blue in any considerable size is never found. In ceilings, or in similiar situations, bluish gray or bluish white marbles will best produce the desired effect—that of distance and size. With red, yellow and orange, the contrary result is obtained, and these should, therefore, be applied to parts it is desired to bring into prominence.

A sense of coldness is produced by a composition in which blue and white predominate, while red, yellow and gold convey the impression of warmth. It is desirable to remember this when designing the fittings and decorations of shops and business premises. A hall or antechamber can be made to heighten by contrast the glory of an interior beyond, if it be paneled with white or pale gray marble, with the dado, cornice, and framing in dark gray, and some of the principal mouldings in black. Red and yellow convey the impression of warmth. It is an error to employ too many varieties of color in one composition. Some of the finest decorative effects have been produced by not more than three varieties of colored marble, and indeed it is seldom advisable to exceed this number unless under special circumstances.—Stonemason.



Roofing Slates in Uruguay.

There is an increasing demand for roofing slates in Uruguay, the modern architect having found that he can build cheaper and better roofs with them. The slates used are the smaller size, 9 by 13 inches. They cost here \$20 per thousand, but to that must be added the duty of \$11.55 per thousand. The round slates are valued at \$21.80 per thousand, but the duty is the same. The retail prices, as used in carpenter's estimates, is from \$34 to \$36 per thousand, with extra for putting them on. None of the 10 by 20 or 12 by 12 sizes are used, the smaller ones having been found satisfactory. The monetary values here stated are in Uruguayan pesos (1 peso=\$1.0352 in United States currency). The slates come in weight freight from England at an average of 15s. (\$3.50) per ton on board of lighter, ordinary breakage at owner's risk. The demand for slate will increase; but, should an American firm deem it worth while to enter the market, it should do so by establishing a depot and keeping it well supplied with the article, including the hardware necessary. The best American slate can find a market here—small at first, it is true, but as slate is the coming roofing material, the future may be relied upon. But it must be borne in mind that stocks must be maintained here, so that orders may be filled at all times. Failure in this direction has been ruinous in many other lines, not only to American interests, but also to those of the English, who persisted in knowing more about the business methods of the country than residents here, and preferred to have only

samples on exhibition. These samples are yet to be seen—and that is all. The Italians and Germans have profited by the advice given them in Consular Reports and are doing a good business.—Albert W. Swalm, Consul, Montevideo.

Laying Slates.

Slates should always be laid with a certain lap, that is, each course should cover the next but one below it to a certain extent, just the same as shingling, and the amount of surface covered should not be less than two inches on the length of the third slate. Thus, there will be a certain width of slate exposed to the weather; this width grows less as the lap of the slate increases. The weathering or gauge for any kind of slating is found by deducting the lap of the slate and then halving the remainder, thus: If countess slates are to be laid with a 3-inch lap, the weathering will be $\frac{20-3}{2}=8\frac{1}{2}$ inches, the countess being 20" long. Each course of slates "breaks joint" with the one below it. The average weight of ordinary slating may be taking at 700 lbs. per square of 100 superficial feet. The valleys of slated roofs are generally laid with lead, as this metal is superior to tin or galvanized iron for the purpose, the lead being turned up the roof on each side of the valley sufficient to drain away all water. Hip rafters are often covered with sheet lead, which is the best method, or finished with thick, saddle-back slates finished on top with some sort of an ornamental roll, which is cut to fit over the angle. Slate does not absorb water, and, as it is hard and close grained and smooth on

the surface it can be laid safely at as low a pitch as $22\frac{1}{2}$ degrees, and its lasting qualities are very great; and, everything taken into consideration, it is a very much cheaper roofing material than shingles in the end. One fault of slate is that it will not resist a very great heat, and is often dangerous on that account, as a fire in an adjacent building may be so hot as to start slates breaking and falling on the heads of onlookers, even if the buildings are thirty or forty feet apart. With the exception of tiles, slates make the prettiest of roofs, if the pitch is not too low, but it seems to be one of the faults of our designers to make their slate roofs much too low in the pitch, owing, no doubt, to reasons of economy. To look well a slate roof should never have less than a one-third pitch, and as much more as circumstances will permit.—Canadian Architect.

[Special Correspondence.]

Brownville, Me.—The Brownville Maine Slate Co. at the Old Crocker Quarries is busy as usual. Ninety men are employed there. The company reports that orders are coming in well, and the management looks forward hopefully to a prosperous season.

The other quarries here are closed, as they have been for some time. It is rumored, however, that the Merrill quarry, which has been idle for several years, may start up soon, working this summer on a large slide that caused the suspension of operations, expecting to be in condition to make slate next winter.

It is not known whether the Highland quarries will start up in the near future or not.

AJAYPEE.

Victory for Non-Unionists.

Union labor received a severe blow June 1, when Judge Sutherland in the Milwaukee superior court handed down a decision to the effect that the contract between the brewers and the labor organizations, whereby the brewers agree not to employ any but union men on their building, is void.

The court says the companies have no right to say what men are to be employed

on the buildings; so long as they are skilled and competent workmen that is sufficient. To go further was unconstitutional.

The direct case on which the decision was rendered was a suit for an injunction brought by Contractor Erdman Schulz to restrain the Schlitz Brewing Company from shutting him out from one of its buildings, on which he was working, because he employed several men who were not union men. The court granted the injunction.

Without passing on the merits of the agreement between the breweries and the trades union, where none but union men were to be employed in any building operations of the companies, the court said it was unlawful, but did not go into the question to any extent.

Export Slate Trade.

The increase in exports of roofing slates from this country is encouraging. The business is still growing rapidly, as shown by the latest report of the Bureau of Statistics, which covers the month of March and the nine months of the fiscal year from July 1 to March 31. The figures of the Bureau do not give quantities, but invoiced values only, and these were as follows for the periods named:

	1897.	1898.	Inc.
March.....	\$ 53,796	\$ 123,555	\$69,759
Nine months....	485,198	1,003,011	517,813

As there have been no marked changes in prices, it is probable that the increase in quantities corresponds very nearly to that in values. For the year so far the exports are more than double those of 1897, and there has been very little variation, each month of the year showing a large gain. The indications are that the ratio of increase will be kept up through the fiscal year. About 70 per cent. of this export trade passes through the port of New York, which takes the slate coming from Pennsylvania quarries, as well as that from the Vermont district. About 13 per cent. of last year's exports were shipped from Philadelphia, coming from the Pennsylvania quarries, while 12 per cent., chiefly "Peach Bottom" slates, passed through Baltimore. The remain-

ing 5 per cent. was about equally divided, part going from Portland, Me., and the rest to Canada by way of the Lakes or the St. Lawrence river. The growth of the export trade has come from sales in Great Britain, which is the best market.

The Home Market.

The efforts of the slate producers seem just now to be concentrated chiefly on the development of the export trade in their products. While this is a promising field and much progress has been made in it, it is a little surprising that more work has not been done in extending the use of slate at home. In certain sections the value and good qualities of slate for roofing are well known and accepted; but through a very large part of the country they are almost unknown. It seems possible that something could be done in the way of advertising slate and extending popular knowledge of its merits and uses. The export business has shown what can be accomplished by well directed work, and there should be some energy to spare for similar work at home.—Engineering and Mining Journal.

Work has been suspended at the Argyl slate quarry, near Wind Gap, of which William Budge, of Pen Argyl, Pa., is lessee and operator. The men brought suit before a justice of the peace in that locality to recover judgment for their March and April wages, and Budge decided to shut down the works until he can get his financial affairs in better condition. About fifty men are out of work cause of the suspension.

The slate dealers of Pawlet, Fairhaven, and other towns in the Western Vermont slate region are exercised over the advance in ocean freight rates from three shillings to seventeen shillings a ton. This, it is feared, will curtail the shipment of sea green roofing slate as it is found impossible to pay the latter rate and realize a profit. Efforts are being made to get English boats to make a reduced rate, but with what results are unknown at present.

The Scotch slaters recently held a convention at Dundee. It was decided that a member rendered unfit for work shall receive \$200 and \$1 a week indefinitely. Apprentices who have served five years are to exact the standard rate of wages. The slaters of Glasgow adopted this: "In the event of a member being unable to follow his employment as a slater through old age, and if he has been a member for 30 years continuously he shall, by applying, receive the sum of \$100 from the Central Board in lieu of all claims, the sum to be levied on members at 12 cents."

The Bangor and East Bangor, Pa., regions produce from 25,000 to 30,000 squares of slate a month, bringing into the two towns from \$75,000 to \$100,000 monthly. The slate making labor in those places is half English, from Cornwall, England, etc., and half Welsh, from Wales. The other labor is of almost every nationality of the world. Pen Argyl, West Bangor and Wind Gap produce also from 25,000 to 30,000 squares a month at a revenue for the places of \$75,000 to \$100,000, the entire region employs from 1,500 to 2,000 men.

The roofing slate shipments of Pen Argyl, Pa., during May this year were 268 car loads. Last year for the same month the shipments were 208 car loads, an increase of 60 cars. Sixty per cent. of this shipment went to England, Ireland, Germany and Australia. The total worth of this last will be about \$44,000, all of which comes to Pen Argyl, and indirectly will circulate through the entire county.

The Brownville, Me., Slate Company has added a large number of men to their force and are now doing a rushing business. The manager, C. E. Williams, says the outlook for business the coming year was never better. The war has apparently not interfered with business in the slightest degree. They are now shipping slate to South Africa, China, Belgium and several other foreign countries to say nothing of the large increase in their domestic trade.

CEMENTS AND LIMES.

Milwaukee Cement.

The rock from which the justly celebrated Milwaukee cement is manufactured was discovered by Joseph R. Berthelet in 1875. The development of this industry proved a success from the start, the first year's sales amounting to 23,000 barrels of cement, and from that time the business has steadily increased until attaining its present very handsome proportions. The character and high grade attained by this cement in Europe as well as the United States, is due to the ability, ingenuity and constant study of Joseph R. Berthelet, son of Mr. Berthelet, by whom the discovery was made. The company's works in Milwaukee are large, modern and in every way complete. A scientific and practical test impartially made by a number of celebrated engineers, among them being Don J. Whittlemore, ex-president of the American Society of Engineers, demonstrated that the Milwaukee product is now the standard cement of the United States for all private and public work, requiring a high grade of mortar and concrete. The establishment as it now stands, turns out material at the rate of 4,000 barrels per day. This means steady employment for 300 men, whose wages for the season—and most of the cement is made in the summer—amounts to over \$100,000.—*Milwaukee Journal*.

The Canadian Cement Industry.

The annual report of the Ontario Bureau of Mines, recently published, states that the number of men employed in the manufacture of cement in the last four years has increase from 168 to 231, the wages paid for labor from

\$44,878 to \$89,060, the quantity of cement manufactured from 85,903 barrels to 181,495 barrels, and the value of the cement from \$109,834 to \$246,425. The greatest increase, however, has taken place in the production of Portland cement, which has gone up from 30,580 barrels to 96,825, while the natural rock cement has only increased from 55,323 barrels to \$84,670. In value natural rock cement shows an increase of \$27,349, while Portland cement shows an increase of \$109,242. This no doubt is largely if not chiefly owing to the growing interest in the building of good roads in our towns and cities.

The Constitution of Hydraulic Cements.

A series of experiments to determine the constitution of hydraulic cements has recently been made by S. B. and W. B. Newberry and described in a paper read before the Society of Chemical Industry. The questions which the authors have attempted to solve are as follows:

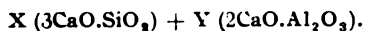
1st. What proportions of lime must be employed for given percentages of silica and alumina in clay? 2d. Can a general formula be stated, applicable to all clays, which shall indicate the proportion of lime which will give the best result with each? 3d. What effect has the presence of oxide of iron in the clay used on the proportion of lime required, and on the quality of the resulting cement? 4th. Is the presence of alkalies in the raw materials necessary to the production of good cement? 5th. Is magnesia capable of replacing lime in cement mixtures, or is it inert, as has often been stated, and how does magnesia affect the quality of the cement obtained?

The plan followed in the efforts to

solve these questions was that of synthesis with pure materials, which were as follows: 1st, silica; ground quartz, in impalpable powder, containing 99.19 per cent. silica. 2d, alumina; C. P. precipitated, containing 99.50 per cent. alumina, .20 per cent. soda, .05 per cent. iron oxide and .25 per cent. silica. 3d, carbonate of lime; precipitated chalk, containing 99.7 per cent. calcium carbonate. 4th, iron oxide; red, German C. P. 5th, magnesia; German C. P., containing only traces of silica, alumina and lime.

All of these materials were in the form of a perfectly impalpable powder, and none of them left any residue on a sieve of 180 meshes to the linear inch. Mixtures of these materials, in calculated proportions, were made by rolling backward and forward on a large sheet of paper, then sifting three times through a 60-mesh sieve. The mixtures were then moistened with water, made into a cake, dried and broken into small pieces for burning. The burning was done in a Fletcher gas furnace, using gasoline gas as fuel.

The conclusions to which the writers are led by the above experiments may be briefly stated as follows: 1. The essential constituents of Portland cement are tri-calcium silicate, with varying proportions of di-calcium aluminate. This composition may therefore be expressed by the formula—



From this formula it may be calculated that the correct proportion of lime, by weight, in Portland cement, is 2.8 times the silica plus 1.1 times the alumina. 2. Iron oxide combines with lime at a high heat, and acts like alumina in promoting the combination of silica and lime. For practical purposes, however, the presence of iron oxide in a clay need not be considered in calculating the proportion of lime required. 3. Alkalies, so far as indicated by the behavior of soda, are of no value in promoting the combination of lime and silica, and probably play no part in the formation of cement. 4. Magnesia, though possessing marked hydraulic properties when ignited alone, yields no hydraulic prod-

ucts when heated with silica, alumina or clay, and probably plays no part in the formation of cement. It is incapable of replacing lime in cement mixtures, the composition of which should be calculated on the basis of the lime only, without regard to the magnesia present.

Lime and Cement in Baltimore.

The lime, cement and sewer-pipe business in Baltimore has reached a solid foundation, and the firms engaged in it are proud of their ability to cope with all competition. Stocks carried are large and of superior quality. The amount of money invested in these and kindred lines makes them compare favorably with leading industries. The export trade is not large in these lines on account of the high rate of transportation, which renders the American shipper unable to cope with foreign prices. Baltimore county produces 1,000,000 bushels of alum lime annually. It is the strongest quality, and can be found nowhere else. Large quantities of it are used in Baltimore, and much of it is barreled and shipped to all parts of the United States. The annual receipts at this port of Portland cement are large, and come from Belgium, Germany and England.

The Chicago Great Western railway has published a tariff, effective May 14, making a rate on cement from Chicago and Milwaukee to St. Paul, Minneapolis and Minnesota Transfer of 10 cents each 100 pounds.

Work has commenced on a cement mill at Falling Springs, about eight miles below East St. Louis, which promises to be one of the largest of its kind in the West. The deposit at this point of hydraulic limestone, from which natural cement is made, is one of the largest west of New York, and its proximity to St. Louis renders it of special value. There is an old mill there already, from which cement was made as far back as 1850. This cement was used in the construction of the Ohio and Mississippi railroad, the St. Louis court house, water works

and many other old but, important structures, yet the mill and the plant were permitted to become obsolete and useless. The mill was for many years owned and controlled by the Standard Cement company, but as there was an abundance of material in the vicinity it is not understood how such an important industry was permitted to remain dormant. A number of St. Louis capitalists are now, however, interested in the movement to open a mill down there, and if the material placed in the hands of E. G. Helm an East St. Louis engineer, proves to be what it is claimed, there is no doubt but that the new industry will add to the material wealth of East St. Louis, as there is hardly any doubt of the establishment of the plant.

The Maryland Cement Company at Sparrow's Point have started work on a contract of 10,000 barrels of cement for Dry Tortugas, Florida. The cement will be used in building the new fortifications. It is expected that the cement will be delivered in ten shipments. Every effort is being made by the company to manufacture the cement as quickly as possible. The works are running night and day with a force of fifty men. One thousand barrels of cement will be shipped to North Point for the new fortifications. The contract there calls for 10,000 barrels.

The Castalia, O., Portland Cement works have commenced operations. The plant cost \$375,000 and about 140 men will be employed. Pittsburg, Pa., capital is most largely interested.

The Cassadaga, N. Y., cement works now turns out one hundred barrels a day of its products. The company is behind with its orders. It will enlarge its factory.

White Pigeon, Mich.—J. R. Watson and other interested parties secured 15 specimens of marl from as many different places and sent to DePauw University, where each specimen will be analyzed. The marl is found in unlimited quantities, and if it all proves good, and there is little doubt but that it will, Cleveland and Frankfort,

Ind., capitalists will take hold of the matter and build a cement factory here. The interested parties will meet at Elkhart to discuss the analyses and perfect plans. If everything is favorable, the buildings will be put up this summer, and everything put in readiness for an early start next spring.

The Coldwater, Mich., Portland Cement Company has signed contracts for four large boilers and four steel rotary furnaces, 60 feet long and six feet in diameter, to cost \$8,000, for five Griffin mills for grinding clinker, with a capacity of 125 barrels per day, to cost \$12,000. The plant is expected to be in full operation by Sept. 1.

Evansville, Pa.—The Newport Cement Company, on the farm of Abraham Heffner, is busy at work erecting the kilns and buildings, and the works are to be put in operation as soon as possible, there being many orders on hand for cement.

Philadelphia, Pa.—In Common Pleas Court No. 2 foreign attachment was issued on the affidavit of J. A. Ridgway against the White Cliffs Portland Cement and Chalk Company, a corporation which is doing business under the laws of Arkansas. Bail was fixed at \$3,000, with the Missouri, Kansas and Texas Trust Company, of Kansas City, named as garnishee.

Tests of Quick-Setting Cement.

Because of the abuse which our quick-setting cements (the natural set of which may be in ten or twenty minutes) receive at the hands of careless or ignorant users by frequent retempering in order to use large batches of mortar extending over a period of several hours, the following tests were made:—

The proportionate reduction of strength would probably hold true for mortars as well as neat tests.

In the tests a large batch of mortar was mixed up and briquettes were moulded from it. At the end of one hour the remaining mass had become appreciably stiffened and was retempered by adding sufficient water and by vigor-

ous working. The same process was gone through each hour, but very soon the activity of the cement was so greatly killed that the setting would not take place for many hours, and very little extra mixing was required.

The "Quebec Natural," corresponding to such United States cements as "Cumberland," "Round Top," etc., has an incipient set of about 30 min. and a full set of 2 to 3 degs. The "Peacock Portland" is a sound, well-burnt, but coarse English cement, having an incipient set of about 20 min. and a full set of 1 to 2 degs.

ones being merely the reworking of a mass which has not set.

2. That the strength of retempered cements is roughly one-half of those not thus treated.

3. That time does not "heal all wounds," as the strength at ten months with the natural cement, and two months with the Portland, has not recovered to any very appreciable extent. This last deduction does not agree with the student thesis on the subject published about two years ago in the Engineering News, which claimed a recovery of strength in course of, say, six months.

I trust that such a memorandum as this will bring out some discussion on the matter from men whose experiences on the subject will be of value to the profession.—Prof. Cecil B. Smith in the Brickbuilder.

The Western Lime Company, at Huntington, Ind., which for a generation has been one of the best money-making enterprises in Indiana, until recently, was operated as a private business concern, there being several partners. It was decided for many reasons that an incorporated form would better suit the needs of the business and at a meeting of the stockholders, Peter Martin, Michael Bates, Jacob Martin, W. W. Hawley, E. T. Taylor, D. M. Hawley, C. E. Hawley, Adam Beck, Adam Beck, Sr., and Harmon Purviance were chosen directors. The officers are: Peter Martin, president; W. W. Hawley, secretary, and Peter Martin, treasurer and manager. Enormous dividends are paid annually on the amount of capital invested.

The Minnesota capitol commission has concluded to use Minnesota cement in the walls of the building, excepting that used in the marble, for which imported cement will be used. This is preferred from fear that domestic cement might stain the marble.

		QUEBEC NATURAL.			PEACOCK PORTLAND.		
Time of Set.	Neat Tensile Strength per square inch.	1 wk.		10 mos.	Time of Set.	Neat Tensile Strength per square inch.	
		1 wk.	1 mo.	1 wk.		1 mo.	2 mos.
Original test.....	157 lbs.	278 lbs.	520 lbs		407 lbs.	515 lbs.	566 lbs.
1st retempering	123 "	210 "	485 "		302 "	341 "	425 "
2nd	80 "	163 "	435 "		184 "	290 "	382 "
3d	73 "	153 "	405 "		185 "	365 "	388 "
4th	52 "	157 "	380 "		.....	165 "	308 "
5th	72 "	172 "	295 "		.....	347 "	383 "
6th	.....	173 "	290 "		.....	310 "	402 "
7th	.....	.....	265 "		.....	332 "	367 "
					9 hours.		
					5 "		
					4 "		
					very slow.		

This table seems to point out two or three things rather clearly:—

1. That the first and second retempering do all the injury, the subsequent

Renounce Sympathetic Strikes.

The Portable Hoisting Engineers' Association, of New York, has withdrawn its representative from the Board of Walking Delegates of the Building Trades Unions of New York. Thus the Board of Walking Delegates has lost one of its strongest allies, and another decisive step has been taken in favor of the movement started by the bosses a short time ago to organize the journeymen of the various building trades into unions which would have no occasion for the services of the walking delegates. It is asserted on reliable authority that the plasterers' union is about to follow the action of the hoisting engineers and withdraw its representative from the Board. The arbitrary methods of the walking delegates and the reckless manner in which they have ordered so-called sympathetic strikes are largely responsible for the dissatisfaction on the part of the unions. The hoisting engineers have been the main factor in upholding the power of the walking delegates. When the delegate has had occasion to discipline any given employer he has been in the habit of ordering the men at the hoisting engine to quit, thus effectively tying up the work, for if the contractor attempted to place a non-union engineer at the throttle, the job was boycotted at once by union men engaged on other parts of the work. Of late the loss of time and wages has created much dissatisfaction. Some years ago the bricklayers' union withdrew their representatives from the Board, and the bricklayers have joined in no sympathetic strikes since that time.

This spring the New York Stone Trade Association closed its yards to the walking delegates and stopped their interference with its work. When the men complained they were promptly locked out and others engaged in their stead. The sympathetic strike which was ordered was a failure and was declared off, with the result that more than a thousand workmen who trusted their fortunes in the hands of the walking delegates are out of work and with little prospect of securing new positions.

In the thirty-story Syndicate Building in Park Row the men in the various trades have lost from two to three months' time since the first sympathetic strike was ordered. The action of the engineers removed the last obstacle. In withdrawing from the Board of Walking Delegates, the hoisting engineers renounce sympathetic strikes, and become allied with the new movement of the master mechanics in organizing unions in which a trade steward is to replace the walking delegate as the official representative of the workmen. The trade steward is to be a mechanic, working at his trade, instead of a salaried inspector whose pay goes on whether the men he represents are idle or working. By this action the walking delegate and the sympathetic strike are likely to be eliminated from the labor situation.

Correction.

In your weekly auxiliary, No. 315, of May 31, my attention has been drawn to an item from Pittsfield, Mass., in which the name of this company is freely used. I wish to say that there is not a word of truth in the article, as far as we are concerned, and would thank you to correct the same in your next issue. Yours truly, THE CLEVELAND STONE CO.,

GEO. H. WORTHINGTON, Pres.
Cleveland, O., June 6, 1898.

Personal.

Mr. Geo. C. Underhill, of Rutland, Vt., well known to readers of STONE as a contributor to its pages, is at present in Europe in the interests of an English syndicate. He expects to return home about the middle of this month.

United States Mineral Production in 1897.

We give in the table on page 24 the completed statistics of the production of minerals and metals in the United States, as collected and arranged for Volume VI. of "The Mineral Industry," which is now in press. This table is the most complete presentation of the results of a year's work in the mineral industry which has ever been made, including more substances and more nearly com-

plete statistics for each than were ever before collected.

Cobb's Current Report.

Henry Ives Cobb, architect for the Chicago Federal building, has made a report to Assistant Secretary Spaulding of the workings of his office for the term of two years just completed. The report is in the nature of a financial exhibit. It shows that on the contracts for the foundation and stone work of the new Chicago building, the saving, as compared to the original estimate of the cost of the work, will be \$328,000. He expects the work upon which the McArthur Bros. are engaged to be completed in July, in spite of the delay caused by the strike at the quarries of the Western Stone Company. The inside machinery of Mr. Cobb's office has been run very inexpensively.

What Load Will a Hoisting Engine Lift?

The horse power required to lift a given load by a pair of hoisting engines, such as are commonly used for the purpose, or by a single engine when a single engine is used, may be found by multiplying the load in pounds by the speed in feet per minute the load is lifted and dividing the product by 33,000. Thus supposing the load to be lifted, including the weight of rope and cage—everything the engine must lift—is 4,000 pounds, and it is to be lifted at a speed of 200 feet per minute. We have

$$\frac{4,000 \times 200}{33,000} = 24 \div \text{horse power.}$$

Call it 25 horse power. This is the actual power required to lift the load, taking no account of friction. It would not be safe to allow less than 20 per cent. for friction. The friction horse power required is $25 \times .20 = 5$ horse power; the total horse power of the engine should be $20 + 5 = 30$.

Again, what load will a pair of hoisting engines lift 180 feet per minute, the engines being 10×24 inches, making 100 revolutions per minute; steam pressure 80 pounds. If the engines are well designed and constructed the mean effective pressure in the cylinders should

be forty pounds; the piston speed is $100 \times 4 = 400$ feet per minute. The area of a 10-inch piston is 78.54 inches. The piston rod is, say, $1\frac{3}{4}$ -inch diameter; half of its cross-sectional area is 1.4 inch. The mean net area of piston—the area less one-half of the area of the piston-rod—is $78.54 - 1.40 = 77.14$ square inches. The horse power developed by one cylinder is

$$\frac{77.14 \times 40 \times 400}{33,000} = 37,$$

and by the two cylinders 74 horse power. Deduct 20 per cent. of this for friction; 20 per cent. of 74 is $74 \times .20 = 14.8$. This leaves the power that is effective for hoisting the load $74 - 14.8 = 59.2$ horse power. To lift a load of 1 pound at a speed of 180 feet per minute will require

$$\frac{1 \times 180}{33,000} = .0054 \text{ horse power;}$$

59.2 horse power will lift $59.2 \times .0054 = 10,549$. The engines will lift 10,549 pounds at a speed of 180 feet per minute.

The proportions of engines, speed of hoisting, size of drum, etc., here assumed are not given as the best. In fact they are not the best. They were assumed at random and simply to indicate the process by which questions likely to arise in relation to hoisting engines may be solved.—Tradesman.

Resigns Office.

Owing to his poor health, and upon his physician's advice, Mr. James Nicholl has been obliged to resign actively as Director and President of the Cleveland Stone Company, Cleveland, O., in order to obtain complete and absolute rest. He has been succeeded in his offices by Mr. Geo. M. Worthington, who assumed the presidency June 1, 1893.

Postponement of Convention of Marble and Granite Dealers.

Owing to the fact that a majority of the dealers will be unable to meet us June 14, and having given notice that they could come a little later, it has been decided to change the date to July 12. Therefore a mass meeting of the Marble and Granite Dealers of Illinois, Iowa,

Nebraska, Kansas, Missouri and South Dakota is hereby called, under the auspices of the Iowa and Nebraska Associations, to meet at Ogden Hotel, Council Bluffs, Iowa, July 12, 1898, at 2 o'clock, p. m.

You are hereby cordially invited to attend.

Remember, everybody will have a voice and vote, member or non-member of any association.

The Trans-Mississippi Exposition, now in operation, insures a railroad rate of one and one-third fare for round trip. Rate at Ogden Hotel, \$1.50 per day.

J. N. KILDOW, } Secretaries.
GEO. J. GRUBER, }

F. B. ALDERMAN, } Presidents.
J. M. GRAHAM, }

"Glen Mont" Granite.

We have an inquiry for the address of the producers of the above named granite. It is said to closely resemble the lightest Barre. Any reader furnishing us address of quarry, will confer a favor.—[Editor STONE.]

Collapse of the Consolidated Tool Co.

"By virtue of a writ of *fieri facias*, to me directed," announced the sheriff of Philadelphia county, he "exposed to public sale or vendue," on June 15, 1898, "the stock, fixtures, machinery and contents" of the plant of the Consolidated Pneumatic Tool Co., general offices in New York City and Boston. We make this announcement so no one may be misguided should they be prompted to open correspondence in response to the beautiful "ad." on another page of this issue. We have been anticipated by the sheriff in collecting our most sacred claim against the defunct company, but that's a common experience with publishers—something they are used to in these parlous times. This company started out with excellent prospects. Men of wealth and reputation became stockholders in it, and they had excellent tools to sell, and splendid shops to make them in. They sold a good many of them, and had orders on their books for a considerable

number when the collapse came. We are sorry that the enterprise has failed, but disagreements, experiments, heavy expenses and patent litigation proved too much, and the logical result followed rather sooner than we expected. It is thought the patterns and machinery have been bought in by parties who will resume the manufacture of the various models of pneumatic tools which the company possessed.

The "Old Man's" Plan.

Stone-cutters have adopted a new policy in managing lockouts and strikes. When out on a strike instead of standing idly by looking at scabs fill their places and become their successors; instead of seeing the bosses smiling serenely at their discomfiture, they form co-operative shops and figure work themselves in competition with their former employers. So far this plan has proved eminently successful in bringing the bosses to their senses. Some of them say they propose to run their business to suit themselves, and if the stone-cutters won't work for the wages they are paying they can "get out." Employers of this character should be taught that in matters concerning the scale of wages two parties are concerned, and both should be consulted. Then the contractors raise the hue and cry of, "You are ruining the business." "Too many firms are figuring the work, cutting prices away below cost, etc." Well, who are we ruining the business for, ourselves or the other fellow? "No, thank you," we appear to be prospering, however, should we allow the other fellow to run the business the shops would be filled with scabs and *he* would be thanking us. "Take the old man's advice for it," the best plan is to both acknowledge the other's rights, and respecting these rights refrain from attempting to strangle each other when a difference arises.

Meet peaceably and talk the matter over like sensible men; give and take as the occasion deserves. Remember the other fellow has "rights" and never hesitate a moment in acknowledging them. You will find this plan to answer far better than long firms, which still permit

the bosses to fill their shops with a lot of riff-raff whom they would not ordinarily allow to shovel out the spauls. Their object is only to keep this scruff until the honest man can be brought to terms, and the scabs are then flung out as so much rubbish or dirt. Try the "old man's" plan for a while and see how it works.—*Stone-Cutters' Journal*.

Bridging the English Channel.

The disagreeable sensations or miseries experienced in crossing that "silver streak" which separates the British Isles from the Continent of Europe, have stimulated invention to suggest many extraordinary proposals for accomplishing the short passage otherwise than by means of a steamboat, and the latest scheme put before the public has at least the charm of novelty. Mr. Boul's project was seriously discussed the other day at Paris, at the annual meeting of the old Channel Bridge Company, and it did not appear to that body so chimerical as to be denied a large measure of support. It will be known to many readers that its main features consist in carrying an electrically-driven train on a platform which would run on a submerged bridge. This bridge is to be some 15 mètres below low water mark, and only this movable platform for carrying trains would be visible above water. A train from the land at either end would simply steam on to this platform, and would thereby be carried to the other extremity, regardless of wind or waves. The Company de Fives-Lille are said to have carefully studied the details of the project, and to be satisfied of its practicability. It is claimed for this system that it possesses simplicity of execution, economy, and absolute safety in working. There would be no obstacles to navigation, and it could be lighted by electricity, so that it might convey trains across by night, if desired. It is estimated that the total cost would not exceed fourteen million pounds sterling, or about one-third that of the bridge above water; and that the work could be completed in five years. Three rolling platforms working simultaneously would suffice for the traffic of

three million tons of merchandise and two million passengers, and would produce a gross annual income of 60 million francs, or a net income of 50 million francs. The platform on which it is proposed the trains should stand would be 150 mètres long and about 15 mètres wide. This would be supported by five iron columns on each side, which would be braced together by iron stays, and would rest upon a submerged platform provided with wheels rolling on rails fixed on the bridge. The electricity would be generated by steam engines and dynamos installed on the upper platform. These are the salient features of the scheme, and in these days of engineering enterprise it would be rash to say it is impossible of execution. There are a host of difficulties, however, in respect of construction and maintenance which are kept in the background, but which will have to be solved before this project can be considered within the range of actual realization.—*Trade Journal's Review*.

Tough Tales from Exchanges.

PETRIFIED TERRAPIN ABOUND.

On the farm of J. W. Wilson is a strip of hill land ten or fifteen feet wide and about 1,700 feet long, which is so stony that nothing will grow on it, and every stone is a petrified terrapin, many of them with their heads out, many with protruding tails and some showing their feet. There are many kinds of stone on this "fault," among which is a limestone that will "dress" itself by the application of fire. On this stone a line can be drawn and a fire can be made along it and the rock will break with a perfect, smooth surface on both sides along the line drawn. Near this, in many places, in inexhaustible quantities, is building sand of the finest quality.—*Lewisburg (Ky.) News*.

HUMAN FORMS INCASED IN SANDSTONE.

In a sandstone quarry in Minnesota recently were found a number of petrified human bodies. The quarry had been open for many years, and hundreds of square feet of earth and rock had been removed when the workmen noticed a strata of softer formation, and in this soft strata were found four petrified human forms. Two of them were over 7 feet in length, while the other two were something over four feet. Day by day the earth is giving up her dead, and we are learning very meagerly, of course, of a people who inhabited this country in a prehistoric age. This find of human forms in the middle of an immense

sandstone rock proves conclusively that our country has an antiquity.

TURNING TO STONE.

Dr. James Wilson McMurray had an interesting patient one day last week. The patient was a man employed nights at the quarries of the Norris & Christian Lime and Stone company. He came into Dr. McMurray's office and complained of being stiff about the joints, and said it was difficult for him to stoop over. Dr. McMurray gave the man's case a very close examination, and to his surprise discovered that the man was suffering from a terrible disease and that ossification had commenced. Parts of his anatomy were simply turning to stone. The doctor could give no reason for this state of affairs any more than that the man explained that he drank much of the water from the quarries. It evidently contains too much lime, and this caused the man's condition to be such as it is. Dr. McMurray explained to the *Star* that this was the first time in his experience that he had ever seen such a case. This is not the first one, however, in history. The man's condition is not incurable by any means, and before long it is believed that he will again be all right.—*Marion (O.) Star*.

BEGS FOR ANOTHER TRUMP.

A Warsaw, Ind., woman, after burying her seventh husband, erected a monument to the whole lot. It consisted of a marble hand with the index finger pointing to the sky, and on the base, instead of the names dates, etc., were the words, "Seven up."

A BALL COMPOSED OF SNAKES.

Workmen in a stone quarry east of Sterling, Ill., made a startling find the other day when a mass of snakes wound into a ball a foot in diameter was brought to light from a crevice in a ledge. The snakes were killed and counted; the bunch was found to contain something over fifty, ranging in length from six inches to two and one-half feet. From appearances all were of the same species.

The Signing of Buildings.

It is occasionally the practice in Paris for buildings to be inscribed with the architect's name, and Belgian architects have now nearly all adopted the custom of inscribing their names on buildings executed from their designs. The position selected for the name is usually at the right hand corner of the main front. The lettering is as a rule small capitals,

and arranged in such manner as to be unobtrusive, and so as not to look like an advertisement. The custom was first initiated by some of the younger members of the profession, and with increasing public interest in architectural matters there has actually been a demand on the part of the general public to have the name of the author of a design as easily seen as is the case with a painting or a piece of sculpture. Of course, some of the profession attempted to utilize the new experiment for advertising purposes, but these were rare exceptions, and the public is perfectly well able to discriminate between the "signature" and an advertisement. An architect's name is rarely to be found on bad work, and in some cases where the work looks like that of a beginner the signature has been erased. A Belgian architect lately remarked that the "signing" should be compulsory for all architects. The bad designer would then soon be weeded out, as public taste would be sufficiently advanced in Belgium to recognize the architectural eyesore, and public opinion would be sufficiently strong to injure the business of the author of architectural aberration. The system of "signing" buildings in Belgium to which we refer can be applied to advantage in the United States, and the results would undoubtedly be equally as good as in Belgium.—*Scientific American Building Edition*.

The Lidgerwood Mfg. Co., New York, has now in preparation a pamphlet describing the Lidgerwood Safety Derrick engine. Their ordinary standard double drum hoisting engine will operate a derrick safely, one drum hoisting the load, and the other the boom. To obtain, however, the maximum capacity out of the derrick the changes of motion are so rapid that accidents frequently occur, hence the demand for a safe and rapid derrick engine which it is claimed is fully met in the Lidgerwood Safety Derrick Engine, patented February 9, 1897.

TIMELY TOPICS

Marble Work in San Francisco. At a recent meeting of the Marble Cutters' and Finishers' Union, of San Francisco, resolutions were unanimously adopted protesting against any further letting of municipal contracts for Eastern marble, except for rough stock to be cut and finished in that city. That, of course, would bar Eastern marble entirely, since the added freightage on the crude material would probably exceed the cost of the required labor on it. The motion of the union is patterned after the "dressed stone" laws of several states, only a little more extreme. The resolutions are as follows:

WHEREAS, During the last few years a number of the largest contracts for marble work in the city of San Francisco have been let to Eastern firms; and

WHEREAS, Such firms do all of the work upon the marble in the Eastern workshops, with scab and prison labor; and

WHEREAS, We have been credibly informed by marble dealers and manufacturers of the city of San Francisco that if the competition with the Eastern firms is to continue, the local dealers and manufacturers must either reduce wages 50 per cent. or go out of business; and

WHEREAS, Such reduction of wages would mean great hardships to 387 marble workers of the city of San Francisco, and the closing of business would bring destitution and starvation to 214 families' doors, and 628 children would be thrown upon the charity of the citizens of the city; and

WHEREAS, The Marble Cutters and Finishers of the city of San Francisco deem it an outrage to the owners of property who are making improvements by building, and the various trustees of public buildings, to allow the awarding of contracts for marble work to go from this city to Eastern firms where they only employ convicts and the cheapest kind of labor, when the work can be executed as well, if not better, in this city and with union labor. The money for this work should be spent in this city, and especially during these trying times, when so

many good mechanics are out of employment and find it hard to support themselves and their families. We know, and are positive, that we have artists at home competent to do any work in an artistic manner, and, moreover, who do the work in this city, thereby putting the money in circulation here. We want all to patronize home industries for mutual benefits; therefore, be it

Resolved, That none of the branches of the building trades of this city of San Francisco will allow any of its members to perform any work upon any building in which the marble is to be furnished by Eastern firms, which do not make the same from rough stock in this city; and be it further

Resolved, That the secretary of the Marble Cutters' and Finishers' Union is instructed to request that all Eastern labor and trades unions shall, as far as they may be able, prevent marble setters from coming to this city to set marble in any of the above cases; and be it further

Resolved, That a committee wait upon the owners of buildings and the architects of the city of San Francisco and request all good citizens to coöperate with this movement in keeping all finished marble work other than the production of crude marble to be worked in this city.

Just what is "Eastern" in the understanding of these complainants the preambles do not disclose, but inasmuch as every lateral mile of territory is "eastern" to San Francisco, we assume the marble of Nevada, Utah and Colorado, as well as the Vermont, Georgia and Tennessee product, is included in the proscription. It probably does not include the California product, though every bit of that also is "eastern" to San Francisco. It does not include it because, quite likely, the producers of California marble are the main inspirers of this protest of the marble workers. Certainly it is not true that "all" Eastern marble firms doing business in that city "do all the work upon the marble in the Eastern workshops

with scab and prison labor." Some of them employ what is stigmatized as scab labor, but that is just as honest labor, if honestly performed, as any other kind. If any of them employ prison labor, it is only necessary for the builder to stipulate that such labor shall not be employed on his work, to prevent it. And that should be a condition of every contract affecting the employment of honest labor of whatever kind. The state can make use of the labor of its criminals in some other way than putting them in competition with that of honest workingmen. But, this discrimination against the products and labor of other sections by any one section, is nefarious in principle and foolish in policy. California has excellent marble resources. If they are ever to be developed and contribute wealth to the state, it must come from the market her quarrymen will find in the East for her marble. Let this spirit of resistance to what is not of local character or origin be followed to its logical sequence, and California will become isolated so far as interchange of commerce is concerned, for reciprocity between the people of a common country is all that makes for progress and power of any nation.

Crushed Stone Experiment. A large city will undertake to demonstrate whether it can run a stone-crushing plant at a saving in cost of crushed stone over price paid contractors. Bridgeport, Conn., is putting in the plant. It has been paying \$1 a ton for trap rock ready to spread. Its mayor says the city can produce the same quality of material and save the taxpayers 40 cents on every ton. If he can do it, he deserves reward. A city of considerable size is a different proposition in the crushed-stone matter than are villages and townships, where the roadways

are highways in a strict technical sense. The country highway sort of roadway is going out of use in up-to-date cities. The mud and dust nuisances are issues of paramount interest with all who take pride in cleanliness and good order. This being the trend in most progressive municipalities, there is some doubt of the economy in city ownership of stone-crushing plants, unless it also undertakes to perform all parts of the work of road building. The experiment of municipal management of manufacturing works has rarely proved successful in an economic sense. The contract system has the advantage in that respect, and the function of the city should be to see that the work is properly executed, rather than to undertake to execute it itself.

Prospects of Peace. Had one wanted to witness a trifle of war during recent years, it would not have been necessary for him to go to Cuba, or any other locality where hostile armies faced each other. He might have visited the Illinois limestone region, anywhere between Summit and Joliet, while a strike of quarriers was on, and he would have seen companies and regiments of men, armed with sticks and stones, parading from point to point and assailing men at work and driving them from their places, while sheriff's posses opposed in feeble resistance such assertion of power. Regularly as the springtime came these hostile demonstrations were expected. Until this spring the quarriers have had no organization, they have had no leaders, and the result has been that the civic authorities have always been able to suppress the outbreaks and restore order. This year the Federation of Labor has the affair in hand, having recently succeeded in organizing the quarriers, and level-headed, reliable men have been put

in command. These leaders are commissioned to confer with the quarrymen and to settle differences between them and their workmen on a peaceful basis. They will very likely be able to do this and in a way to satisfy the men. We think, therefore, there will be a restraint to the lawlessness that has for so many years been a recurrent event in this section. The men have acted wisely in becoming organized. Experience has taught them wisdom. Let the quarry owners meet them in a spirit of fairness.

Pointing Not one sigh of genuine sympathy goes out to Joe

a Moral. Leiter in his misfortune—not even from Levi, his dad. And yet his deal in wheat which boosted the price of that staple from less than 70 cents to \$1.85 a bushel, made thousands of farmers rich, tore the blanket mortgages from millions of acres of land, refurnished thousands of impoverished homes, and did as much as any one thing lately to dispel the shadow of commercial depression that has brooded over the land so long. Human sympathy is very fickle in an affair of that sort. What a mighty lesson does this young man's overthrow impart, however! It is meet that he receive no honor for what good he did others, for he was not concerned with that particular feature in his exploit. Joe and Levi, doubly and singly, were bent on adding to the Leiter millions, and had no compunction over the rise in the price of the poor man's loaf of bread. Their defeat is only another chapter in the old, old story—no man, nor set of men, can overcome in a contest with Nature. There was more wheat in the last harvest than Joe had knowledge of. Nature was more bountiful than the crop reporters gave it credit, and Joe put too much trust in the records and not enough in the actual

yield. But, it was not that that brought him down beyond the point where he could have crawled from under. Levi appears to have lost nerve, and wouldn't put up any more of his supposed plethora of cash, nor would the banks do so when Levi drew in. So, Joe was clipped. At this writing it looks as if a father had interfered with the plans of a son who is wiser than his dad when left to his own volition—or, it is a plot that will develop next fall, when the pair will recoup their apparent losses by a master stroke that will startle the world. We refer to this subject herein simply for the moral in it that concerns everybody. It shows that a couple of men with money may so use it as to bring the effects directly home to every man, woman and child in the universe.

Qualities of a Durable Stone. The durability of building stones is indicated by their chemical composition, both in the crystalline and the non-crystalline, or sedimentary groups. And the nature of both the grains and the cementing material is to be considered. The latter may be such as to be readily acted upon by atmospheric elements, and the stone fall to pieces as a heap of quartzose sand, each grain of which, by itself, would have resisted for ages. Without the bond the tottering wall gives away. The principal atmospheric agents which attack stone are carbonic, hydrochloric, nitric, and sulphuric acids, ammonia, and several organic acids. These agents, carried by rainwater, act by solution, oxidation, deoxidation and hydration and the constituent minerals as well as the cement are affected by them. And the durability of any given stone is determined by that chemical constitution which is least liable to change under their action.



CLEVELAND, O.

The state of trade at the present writing is very encouraging to say the least. No jobs have come out this last month. But it is a positive fact that considerable work is lying in the different architect's offices, but owing to the uncertainty of the duration of the war with Spain, and its necessary expense involving an increase in taxes, etc., the owners will not consent to the work going on.

The Park and Boulevard Commissioners are letting out some work, but it is of an inferior quality, and they allow any old farmer to bid upon it, and consequently it is being done by slipshod workmen at little or no wages. Very few mechanics get work upon such jobs, as they will not work for such wages.

Cleveland, O., May 29. GEORGE.

KANSAS CITY, MO.

A good many stone-cutters of this city are cutting curbing at present. Four or five miles of it are needed just now, mostly stone. But cement is coming more and more in use, all imported Portland. The stone yards have very little to do.

The contract for the foundation of the convention hall was let to Muselman for \$23,000.

Kansas City, Mo., May 25. C. E.

PEORIA, ILL.

The Christian Science Church was let here last week; the outside walls are to have Bedford stone facing; cost \$18,000. F. Hasebrook, of this city secured the contract.

Bids are to be opened on the 25th of this month on the Incurable Insane Asylum job.

In real estate, desirable lots are changing hands, and some new developments are expected in the near future. A large hotel and an Assembly Hall are among the expectations.

Peoria, Ill., May 24. SCALLY.

FAIRMONT, WEST VIRGINIA.

Work on a new school house has commenced here. Stone trimmings. Numerous minor contracts are under way. Prospects for the resumption of work on the courthouse are encouraging for the first of June. Warrington—a neighboring oil town—has two churches with stone trimmings in course of erection. Taking a trip from this town and return by way of Morgantown, W. Va., Uniontown, Pa., Charleroi, Pa., Little Washington and Wheeling, trade seems very dull. Charleroi will have a new bank, stone front, to cost about \$20,000. The founda-

tion is partly completed and the cut stone work will be let in about a month.

Always enjoying your magazine and its timely articles, and hoping that I will have more encouraging news to send for next issue.

Fairmont, W. Va., May 22. ABERNETHY.

DAYTON, OHIO.

The contract for Saint Patrick's Church of Middletown, Ohio has been awarded. Don't know name of successful bidder.

The King Bridge Co., of Cleveland, was awarded the contract for both the new spans to be erected on the Miamisburg river bridges, the upper span of 225 feet, was let at \$7,300, and the lower of 235 feet, at \$8,400. The new bids advertised for stone work will be opened May 26, for the new flat building on the corner of Third and Ludlow streets. The foundation is about half down. The architect has not finished the details as yet for the upper part, so that is a drawback for the stone work and also all other work.

D'ONOFRIO.

Dayton, Ohio, May 19.

SAULT ST. MARIE, MICHIGAN.

There is nothing doing here in the building line. I think there will be lots of work here shortly. There is a brick veneered block three stories high, stone sills and trimmings, to be let this month. Cost—\$8,000. When the water power is a settled affair, there will be quite a building boom in the Soo. There is an addition to the asylum at Newberry, sixty miles west of this city, to cost \$25,000. It will soon be open for bids. All brick, with stone trimmings.

MILLER.

Sault St. Marie, May 16.

ROCHESTER, NEW YORK.

Business in the stone line is still quite dull here, but prospects are somewhat brighter than when I last wrote you. There is talk of two churches being built, and two or three school houses, which will be brick with stone trimmings. There will also be a county building for the insane.

Work on the Erie Canal is completed for this year, thus putting many stone masons and cutters out of employment.

MCLEROY.

Rochester, New York, May 22.

SCRANTON, PENNSYLVANIA.

The only thing in the construction line in this city, with the exception of a few small buildings, is a new railroad between this city—which is the center of Pennsylvania's rich anthracite coal fields—and tidewater. The road, which is to be called the New York, Wyoming and Western R. R., will run from some point in or near this city, to New York City or somewhere near Newburg, N. Y. It is to follow closely the route of the Delaware, Lackawanna

and Western R. R., and will, consequently necessitate the construction of several bridges as well as having much heavy cutting for the grade, as it is through the most precipitous portion of the Pocono Mountains. The reason the new road is being built is that the coal carrying companies, who own mines of their own, charge the individual coal operators such exorbitant freight rates; as a consequence of the enormous rates for carrying anthracite coal to market, bituminous coal is fast crowding anthracite out of use in the great consuming centers. The individual operators hope, by having a road of their own, to compete, at greater advantage to themselves and their customers, with their rivals in the coal industry. Mr. E. B. Sturgess, who was the prime mover in having the New York, Ontario and Western R. R., extended into this city, is the president of the new company; Ex-Lieutenant Governor L. A. Waters is vice president; Thos. E. Jones, secretary; and Thos. H. Watkins, treasurer. Among the remainder of the stockholders and directors are such well known millionaire coal operators as Congressman Wm. Connell, John Jermyn and his son Joseph J. Jermyn, who, as well as the officers of the company are all residents of this city. A corps of engineers has already been engaged and a charter obtained from the State of New Jersey, so that the new road is an assured fact. GOWAN.

Scranton, Pennsylvania, May 16.

BEDFORD, INDIANA.

The Bedford Belt R. R., have started to put in the foundation for the machine shop. The Salem and Bedford Co., are cutting a job. J. E. Evans has a contract of seventy-two markers for graves 4'0" x 3'0" x 3'0". All the mills are running. The city let a contract to a Ohio firm to improve four squares of 15th St., with brick, the sidewalks and curb will be of Bedford stone. EDGAR.

Bedford, Indiana, May 22.

PUEBLO, COLORADO.

Things look better here than they have for some time. There are several residences spoken about, also an addition to the County Clerk's office. This is to be all stone. There was one of the biggest jobs let here on the 19th, that has been let for years. It is a reservoir at Twin Lakes, above Leadville. The contract price is \$100,000. There is quite a lot of mason work and stone cutting in the job. Headquarters for the company are to be in Pueblo.

Pueblo, Colorado, May 22.

ALLAN.

ST. PAUL, MINN.

The scraping of countless great saws and the incessant hammering of blacksmiths, stone-cutters and carpenters makes a din at the new

capitol, which during the night time can be heard for blocks. Contractor Butler is working the machine-saws twenty-four hours a day and the great planers twenty-one hours a day. The marble-cutting plant is something unique in this part of the country, this being the only one west of Chicago. The machinery is very massive, and requires a 100-horse power engine to operate it. Up to date about 125 carloads of marble have arrived in the city from Georgia. The blocks come two to a car and weigh about twenty tons each. Two of these immense blocks can be sawed at the same time under one of the immense machines at the capitol grounds. The veneer of marble for the capitol building will be five inches thick. The contractors expect to have the building up as far as the second story, where the Corinthian column commences, before fall.

About 30,000 square feet of the granite walls of the basement and first story have already been put in place. The granite is coming from the St. Cloud quarries as fast as it can be used. There are in the neighborhood of 300 men now on the pay rolls of the contractors. The brick work inside of the building is being pushed as rapidly as possible. PAULUS.

St. Paul, Minn., May 21.

FAITH, N. C.

The war seems to be helping out the granite in this section. A large number of quarries are working and everybody has all they can do. One man has just come in on the granite belt here and put up a large granite crusher and is running steam drills. There is room and fine locations for several more. One man has received an order for 100 car loads of granite curbing and there are lots of fine building stones being gotten out by different companies, and everything is lively here now. Gold was used to pay off with last pay-day. J. T. WYATT.

Faith, N. C.

FORT WORTH, TEXAS.

The state of the stone trade here is bad at the present time. Nothing doing whatever. The Union Depot has been revived again and it is now reported that the depot company would soon advertise for plans. Depot and approaches, to cost \$200,000.

No new jobs to come out in any of the surrounding towns that I can learn of. At the present time Dallas is pretty busy in the stone line. The Bedford stone is just being introduced in that market.

Fort Worth, Texas.

TEXAS.

MANSFIELD, OHIO.

The board of managers of the Ohio State Reformatory, Mansfield, O., have decided to advertise for bids for the stone work on the new

wing of above named building, which is intended to be commenced this season.

Mr. A. Howard, Galion, O., is building a residence of pressed brick and stone trimmings. Vernon Redding, Mansfield, architect. Messrs. Rogers and Shuck of Ashland, O., are going to erect a double family vault in the cemetery at that city.

Mansfield, Ohio.

O'CONNOR.

SEATTLE, WASH.

Annex to Cascade school \$30,000. Let by school board; brick and stone trimmed.

Magnolia Bluff army post building to be let soon, principally rubble masonry, some cut stone. Bids opened and now under consideration by Quartermaster Robinson.

The Great Northern railroad will soon be making improvements on its terminal property here, which if carried out means a large expenditure of money.

Citizens will soon be asked to vote on the proposition of building a high school building to cost about \$125,000.

Yukon river gold is looked for here soon. Every trader knows that means trade.

Seattle, Wash.

WARE.

GRAND RAPIDS, MICH.

Architect Robinson, of this city, is preparing plans for a Polish Catholic school in Manistee, Mich., to cost about \$30,000. Also a store building for Sproul & McGurrin, to cost about \$10,000. He has also drawn plans for extensive alterations for the residence of Freeman Godfrey, to cost about \$5,000.

Contracts are let for the Rindge-Kalmbach shoe factory, to cost about \$75,000.

Grand Rapids, Mich.

M. T.

EVANSVILLE, IND.

I have nothing to report in building line; there are no plans in the architects' offices, and bricklayers and stone-cutters are idle—not a

stone-cutter employed. The only prospective work is the new water-works building; plans are out by Mr. Hermans, of Louisville, Ky. engineer. In order to save money the board will do away with most of the stone work as now planned.

I hear also the smokestack is to be of steel instead of brick and stone, which will cut short the masons. All other work is about completed, and such idleness as now exists in the building trades was never known.

Evansville, Ind.

SCHOENBAUM.

TERRE HAUTE, IND.

The Big 4 Railroad Company has awarded the contract for their new depot to a contractor here. Report has it that somewhere about \$60,000 is to be expended on buildings, train sheds, etc. The stone item is small, under \$2,000.

The Terre Haute Stone Co. has secured the contract for a private vault for the cemetery in this city. It is to be out of Eastern granite; cost somewhere about \$6,000.

Very little is being done in the building line, nor are there any reports that would be encouraging.

Terre Haute, Ind., June 15.

C.

PARKERSBURG, W. VA.

The trade looks very good for this month. The contract for Trinity church was awarded to Matt Reich, of this city.

The contract for the Kathnecker Block was given to Keenan Bros.

The bidding on the Citizens' Bank for superstructure is mixed up. There were five bids on job complete, and about 40 on parts of work. The complete bids were all thrown out as being too high, and it will take a week to decide who are the lowest on the different branches.

Architect H. C. Warne has the plans for a block for Mather the jeweler, three stories, all stone; will be let this week.

John Daniels has just completed a basement 23 feet high for Judge Jackson on Prospect Hill.

Parkersburg, W. Va.

STOYLE.

SELECTED MISCELLANY.

The Yankee Spirit.



O LD Uncle Sam he sez, I guess
 I'm gittin' played out," sez he,
 "They're growin' so big in the big
 U. S.
 That they've got no use fer me.
 The East and West don't seem ter
 hitch
 And the North and South won't
 mix,
 And all that jibes with their pesky tribes
 Is money and politics."

Old Uncle Sam had said his word
 And he set him down and sighed,
 But a sneakin', mean, little rascal heard,
 That lived on the other side.
 "Well now," sez he, "I can pay my grudge,
 That feller is almost gone,
 Here's a chance ter lick." So he fetched a kick
 On Old Uncle Sam's pet corn.

Old Uncle Sam he felt the whack,
 And riz with a kinder moan,
 "My folks hain't standin' behind my back,"
 Sez he, "I must fight alone;"—
 He stopped, fer up from the land behind,
 In thunderin' crash and beat,
 Rang out the hums of a thousand drums
 And the tramp of a million feet.

Old Uncle Sam he turned his head
 And looked at a monstrous throng
 Who sang with the starry flag outspread,
 The old "Star Spangled" song.
 And there wa'n't no North and there wa'n't no
 South
 And there wa'n't no East nor West,
 But each was a part of a mighty heart
 That beat in a Nation's breast.

Old Uncle Sam he heard 'em yell
 In a voice like the Ocean's roar,
 "Go in, and we'll back yer up as well
 As our fathers done afore.
 We'll give yer money, we'll give yer men,
 We're with yer heart and hand,
 And we'll strew our slain from the Gulf ter
 Maine
 For the honor of Yankeeland."

Old Uncle Sam he whirled around,
 And his face was all aglow,
 And he sorter smiled at that furrin hound
 And he sez "Well, I dunno,
 We may seem lost in the greed fer gold,
 Divided and all upset,
 But when we're right and we've got ter fight,
 I reckon we're true blue yet."

—Joe Lincoln in L. A. W. Bulletin.

Cost of Broken Stone Roads.

The cost of broken stone for building roads is not so great as many suppose. It can be bought at the crushers for 40 cents per solid yard, and the railroad will freight it forty miles, or less, at about 50 cents per cubic yard, making a total of 90 cents; but suppose we call it \$1. Then if the roadbed is nine feet wide and the stone is piled on a foot deep, a cubic yard will cover three feet linear at a cost of \$1, making one mile (1,760 yards) cost as many dollars. But as only about nine inches are necessary, one-fourth of this amount, or \$440, should be deducted, making the exact amount only, \$1,320, which is cheap enough for a first-class road, the material for which must be brought forty miles by rail.—
 Indiana Farmer.

The Genius of Invention.

A very interesting question relative to the nature of invention has recently been under discussion in the columns of the technical press. It is an idea firmly fixed in the popular mind that inventions are produced only by persons peculiarly endowed by nature with what is called "the inventive faculty," a sort of inspiration of genius. This is, in fact, the basis upon which rests the whole system of our patent laws, which are framed for the encouragement of persons so endowed to use their peculiar faculty for the public benefit. It is remarkable that this idea is generally negated by the very persons who might reasonably be expected to favor it—the inventors themselves. An eminent man of science has defined genius as "capacity for endless hard work." Edison, when applied to for an opinion as to the inspiration of inventive genius, is said to have exclaimed: "Inspiration! Bah, it is perspiration." When the mists of prejudice have cleared away, it will doubtless be acknowledged that invention, like every agency in nature, is a process of evolution. Even in the case of such astounding achievements as the telephone and phonograph, which have startled

the public with their apparent originality, the germ will be found by investigation in some long abandoned attempt which has failed because the times and means were not opportune. Lying dormant or struggling up through difficulty and failure until favoring conditions supervened, it burst upon the public view like a new creation, but to be followed by a long course of growth and improvement, with ideal perfection forever in the future.—Electrical Review.

How to Make Black "Marble."

A black marble of similar character to that exported from Belgium—the latter product being simply prepared slate—may be produced in the following manner: The slate suitable for such purpose is first well and smoothly polished with a sandstone, so that no visible impression is made on it with a chisel—this being the rough—after which it is polished finely with artificial pumice stone, and finely finished with extremely light natural pumice stone, the surface now presenting a velvet-like, soft appearance. After being allowed to dry, and the surface being thoroughly heated, the finely polished surface is impregnated with a mixture heated, of oil and fine lampblack. This is allowed to remain for twelve hours; and according to whether the slate used is more or less gray, the process is repeated until the gray appearance is lost. Polishing thoroughly with emery on a linen rag follows, and the finishing polish is with tin ashes to which is added some lampblack. A finish being thus made, wax dissolved in turpentine, with some lampblack, is spread on the polished plate, warmed again, which after a while is rubbed off vigorously with a clean linen rag. Treated thus the slate has a deep black appearance like black marble, the polish being just as durable as the latter.—New York Sun.

Ship Canal as a Consequence of the War.

The energy awakened by our early wars against England gave us the Erie Canal the national pike, and the development of Western river navigation. The Civil War gave us our great transcontinental railroads. The present war with Spain must, if its logic is heeded, give us a transisthmian ship canal. The Pacific is to be the theater of great events and of a rapidly expanding commerce in the years to come. We need the Nicaragua Canal in order to give our Eastern seaboard a fair oppor-

tunity in the Oriental trade. We need it also for our trade with our own Pacific coast and with the western coast of South America. It is now evident, moreover, that we need the Nicaragua Canal as a defense measure. The naval situation in the West Indies last month showed how much might possibly have depended upon the prompt arrival of the Oregon, which has required some ten weeks to proceed by the way of Cape Horn from San Francisco to Key West. On the other hand, the naval situation in the Philippines showed how, under certain contingencies, it might have been necessary to send a relief expedition to Admiral Dewey from the Atlantic coast. The United States government could readily afford to take the financial risk of the Nicaragua Canal purely on grounds of public defense. The canal would probably pay its way out of the tolls upon commerce; but even if there were some annual deficiency to be met, it would be the most economical part of our annual naval bill. Thus far, the war has shown that we need a coaling station or two in the West Indies, that we need the Hawaiian Islands, and that we need the Nicaragua Canal as an out-and-out territorial possession of the United States. The canal ought to be built as a direct governmental undertaking, and ought to be cut through a strip of ground owned by the United States as absolutely as our government owns the District of Columbia. No other plan will suffice.—From "The Progress of the World," in American Monthly Review of Reviews for June.

Indian Inlaid Work.

The use of inlaid stone in true mosaic work by the Mongols in India was principally due to the revival of the ancient art in Italy. The Italians of the Renaissance developed two distinct forms of inlaying in stone, the Roman mosaics of the modern jewelers, which may be compared to the *opus minus vermiculatum*, and the Florentine, composed of thin slices of different colored stones, chiefly quartzose, cut to the shape of the form they are intended to represent—the petal of a flower, the wing of a bird, or whatever it may be—and set in white or black marble with cement, of which in good work not a trace should appear between the encrusted stones and the marble, not even when seen through a magnifying glass. It was this Florentine form of mosaic in *pietra dura* which was used by Austin De Bordeaux in the decoration of the glorious Taj-Mahal, and which

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ASTOR, LENOX AND
TILDEN FOUNDATIONS.

has become naturalized as a local art at Agra. Austin's earlier work at Delhi appears to have been purely imitative, as may be seen from several specimens of it now in the India Museum. The mosaic representing Orpheus is interesting from its being supposed to be a portrait of Austin himself. It was looted at the recapture of Delhi from the mutineers in 1857, and was purchased for the India Museum from Sir John Jones. The *pavimentum Græcanicum* of Pliny was a concrete composition of charcoal, sand, lime, and ashes, rammed down and polished to represent black marble. Omitting the charcoal this is pretty much the composition of the "chunam" walls and floors, in imitation of white marble, which are seen all over India in superior houses, and in the Madras Presidency in particular, and remarkable for their high polish and real look of white marble. The commoner chunam stucco, made of kankar and pounded sand, is indeed the Roman *arenatum*, and the finer sort, in which pounded marble or calc-spar is substituted for sand, is the Roman *marmoratum*. When this stucco is decorated in various designs, as a sort of false mosaic, it may be compared to the painting in colored plasters which has long been recognized in Europe as a special art. In al fresco painting the colors are soaked into the plaster while it is still damp, and thus the design is indelibly fixed to the hardening surface. In a *tempera* painting the colors, mixed with size to make them adhere, are put on the plaster after it has hardened. Often the background of a composition is painted in al fresco, and the figures of the foreground in a *tempera*. When a plaster is etched in a manner resembling the *pavimentum sculpturatum* the work is called sgraffito.

The term encaustic painting, now used only for the painting of glazed tiles, was first applied to a *tempera* painting in which the vehicle of the colors used was wax spread over the surface of the stucco with a heated iron or "actual cautery."—Illustrated Carpenter and Builder.

Occupations of Americans.

Much interesting data about the occupations of the American people is given in the bulletin of the Eleventh Census recently made public. It shows that the total number of people engaged in occupations of all kinds in 1890 was 22,735,961. Of the whole number of working people the females form 17.22 per cent. Divided by classes the working people of the country

are as follows: Agriculture, fisheries, and mining, 9,013,336; professional, 944,333; domestic and personal service, 4,360,577; trade and transportation, 3,326,122; manufacturing and mechanical industries, 5,091,293. Considerably more than four-fifths of the illiterate male population of the country and over one-fourth of the illiterate female population are working. Over 59 per cent. of the workmen are married, over 27 per cent. single, over 3 per cent. widowed, and one-quarter of one per cent. divorced. In manufactures and mechanics the carpenters and joiners numbering 611,482, make up the greatest element, with dress-makers and milliners following, with 499,690. There are a little over 1,000,000 bookkeepers, clerks, and salesmen, 690,658 merchants and dealers, 5,281,557 farmers, planters, and overseers, and 3,004,061 agricultural laborers, 349,592 miners, and only a little over 60,000 fishermen and oystermen. Professors and teachers, aggregating 347,344, form the most numerous of the professional classes. Physicians and surgeons, 104,805, come next; then lawyers, 89,630; clergymen, 88,203; government officials, 79,664; musicians, etc., 62,155; engineers and surveyors, 43,239; artists and art teachers, 22,496; journalists, 21,849; and actors, 9,728.

Liquid Air for Blasting.

The most interesting application of liquid air which has hitherto been tried on a commercial scale, is to make an explosive by mixing it with carbon. So said Professor Ewing in the paper he read before the London Society of Arts on March 2. When liquid air, enriched by the evaporation of a large part of its nitrogen, is mixed with powdered charcoal, it forms an explosive comparable in power to dynamite, and which, like dynamite, can be made to go off violently by using a detonator. To make the explosive, the liquid, containing about 40 or 50 per cent. of oxygen, is poured on fragments of wood charcoal, two to four cubic millimeters in size. These are kept from scattering under the ebullition of the liquid by mixing them into a sort of sponge with about one-third of their weight of cotton wool. The liquid which remains is, of course, richer in oxygen than that which is originally applied, and when the mixture is allowed to stand long all the liquid evaporates and the explosive power disappears. It must, therefore, be mixed at or near the place where it is to be

used. But the cotton wadding, impregnated with coarse charcoal powder, can take up more than enough of the liquid to supply oxygen for its complete combustion, and when put quickly into thick insulating cases of paper, it retains its full explosive power for five or ten minutes. After an interval, which ranges from fifteen to thirty minutes, according to the size of the cartridge, all explosive power is lost. Experiments were made with this explosive on the parade ground at Munich, and a practical test on a large scale has gone on for some months in a coal mine at Pensburg, not far from Munich. The trials there were continued from July to October of last year, and are claimed to have given very satisfactory results. The chief advantage of the explosive is its cheapness, the cost being simply that of the power used in liquefying the air. Even the fact that after a short time the mixture ceases to be capable of exploding may be urged as a recommendation in one respect, for if a detonator hangs fire there is no danger of the charge going off accidentally some time after the explosion is due; nor is there any danger of its being purloined or used for criminal purposes. It is questionable, however, if such an unstable explosive can ever be found either convenient or economical, except, perhaps, in large quarries where a large amount of blasting is to be done at one place.

Air Insulation in Buildings.

We are told that nothing keeps cold and heat out better than a layer of air; hence the use of horizontal and vertical air passages and of hollow walls in our buildings. When Russner published an account of some experiments a year ago which contradicted this view, he found, says the "*Zeitschrift für Architectur und Ingenieurwesen*," very few supporters besides men like Astfalck and Nussbaum, who had come to the same opinion from other considerations. Russner's experiments were not unobjectionable. He has now repeated his experiments, and he seems to have established his case. He fixed auxiliary walls more or less close to the outer walls of a room, heated the inside surface of the inner wall, and measured the temperature on the other face of that wall and of the air between the two walls. The partition walls were solid or hollow; they were heated by placing heated iron boxes against them, and the temperature of the other surface was determined with the aid of little pockets containing mercury and thermometers, and

further of thermopiles. It resulted that the heat penetrated walls one or half a stone in thickness, whether they were solid or hollow, almost equally quick, while the propagation through hollow walls packed with sawdust and other insulating materials was much slower. The experiments continued for eleven hours. The propagation of the heat through the air was, of course, the work of radiation, and if the conditions were favorable for radiation, then insulation was not much good. Kieselguhr, slag wool, even peat and sawdust are much better than an air space, but the latter are too hygroscopic, and therefore unsuitable. Astfalck has rejected narrow air spaces because they favor sweating, which spoils the walls and woodwork, and makes them unhealthy. To keep our walls warm in winter, we may clothe them inside with cork, paper stuff, or kieselguhr, especially if the walls consist of hard burnt bricks or natural stones which are fair conductors of heat.

United States Bonds.

United States bonds are recognized as the most secure and stable form of obligation that investors can hold. They are attractive, not only because of the absolute security offered, but because there is at all times a public market for them on which holders can quickly sell; and they also offer the most desirable form of collateral if the holder wishes to secure a temporary loan. The fact that United States bonds are not subject to taxes of any character—Federal, state or municipal—is a valuable feature of that form of investment. United States bonds are issued in both coupon and registered form.

COUPON BONDS.

A coupon bond is payable to the bearer. It may be bought and sold without formality as freely as any kind of property and without indorsements of any kind. Owing to the freedom of transfer, coupon bonds are usually preferred by persons who expect to hold them but a short time. Their disadvantage for the person who wishes to make a permanent investment lies in the danger that they might be lost or stolen, in which case the loss to the owner would be as complete as would be the loss of a bank note. The coupon bonds take their name from the method by which interest is collected by the holder.

Printed on the same sheet with the bond is a series of coupons or small certificates of inter-

est due, which are so designed that one is cut off at each interest period. Each coupon bears the number of the bond and shows the date of the coupon's maturity. The holder of a coupon bond, at each interest period, detaches the coupon due that day and collects it. The coupons are payable at any Sub-Treasury, and may be collected through any bank, and will usually be accepted by any merchant having a bank account, with whom the holder of the bond has dealings. The holder of a coupon bond may at any time have it converted into a registered bond free of charge.

REGISTERED BONDS.

A registered bond is payable to the order of the owner, and can only be transferred by being properly indorsed and assigned by the owner. Such assignment is made by the owner filling in the blank form on the back of the bond, and must be witnessed by some officer authorized by the regulations of the Treasury Department to witness assignments. The owner of the registered bond who wishes to part with it writes his name on the back of the bond in the presence of the officer; then the witnessing officer writes his name in its proper place and affixes an impression of his official seal.

The officers who are authorized to witness assignments are a United States judge, United States district attorney, clerk of a United States court, collector of customs, collector or assessor of internal revenue, United States Treasurer or Assistant Treasurer, or the president or cashier of a national bank, or if in a foreign country a United States minister or consul. In cases where there is no officer within a reasonable distance, or when, through sickness or for some other good reason, the owner of registered bonds cannot go before one of these officers, the Treasury Department will designate some person near the owner to act as witness.

When the owner of a registered bond disposes of it and has properly assigned it, he delivers it to the new owner, who should at once forward it to the Register of the Treasury for transfer on the books of the Department. The Register cancels the bond so forwarded and issues a new bond in the name of the new owner, and sends it to him by registered mail. The Department makes no charge for transferring bonds.

If the owner of a registered bond loses it, or it is stolen from him, he should at once notify the Secretary of the Treasury. A stoppage will be entered against the bond, and, if it should

be presented for transfer, the Department will hold possession of the bond until the ownership is clearly established. If a lost or stolen bond is not recovered within six months, the Department will issue a duplicate bond upon proof of loss and a bond of indemnity being furnished.

The interest on registered bonds is paid by the government by means of checks. In order that no mistake may be made in the payment of interest, the books of the department are "closed" for a period, varying according to the importance of the loan. The books of the 4 per cent. loan of 1907 are closed for the whole month preceding the payment of a quarter's interest. On other loans the books are closed for fifteen days preceding the interest payment. During this period the transfers are made, and the time is devoted to preparing "schedules" which contain the names of the owners, the amount of bonds each one holds, and the amount of interest due each one. When these schedules have been prepared and proved, they are sent to the Treasurer of the United States, who immediately has checks and envelopes addressed, and in due time each check is mailed to the address of its owner. The checks for the more distant points are first mailed. Interest checks are obligations of the United States, and, of course, are good everywhere.

Coupon bonds are issued in denominations of \$20, \$100, \$500, and \$1,000. Registered bonds are issued in denominations of \$20, \$100, \$500, \$1,000, \$5,000, and \$10,000.

HOW TO SUBSCRIBE FOR THE NEW BONDS.

The war loan which is now being offered will be sold to subscribers at par during the period of subscription, which ends July 14, 1898. The method of subscription has been made as simple as possible. Blank forms may be obtained at every money order postoffice, and at most of the banks and express offices and on these forms is clearly indicated all that is necessary for the subscriber to fill out. The subscriber may himself mail to the Treasury Department at Washington the blank form filled out, together with his remittance covering the par value of the amount of bonds for which he wishes to subscribe. That remittance may be in whatever form best suits the subscriber's convenience—in currency, bank draft, check, postoffice money order, or express money order. The day the currency is received from the checks, drafts, or money orders, the subscription will be entered and will imme-

diately begin drawing interest. When the bonds are delivered, a check will accompany each delivery covering the interest at 3 per cent. from the day the subscription is entered to the 1st of August, the date of the bonds, and from which date the bonds will carry their own interest.

Welcome to the Robin.

The winter is long for the hewer of stone,
For he's seldom "bankered" then,
And the time drags heavily on his hands
With very few dimes to spend.
But while his "kit" is gathering rust
And the weeks seem never to end,
He contemplates how he'll get the dust
When the robins nest again.

He tramps around in quest of work
To keep the wolf from his door;
He figures and plans to do what he can
To tide the cold winter o'er.
He works the grocer and butcher for trust
And the coal man to fill up his bin;
But he'll give them a lift, for he'll have the
"dust,"
When the robins nest again.

And if by chance he is "bankered high"
When the winter closes in,
He is ill-at-ease in an overcoat
All buttoned up to the chin.
He is clumsy and slow when bundled up so,
He can't do much rumping then,
But he'll give it "fits" in a month or so
When the robins nest again.
—Straight Edge in Binghamton Independent

The Insect Cement-Maker.

The wasp is not a vegetarian like the bee, and our cement-maker has before her a problem of supplying her young with meat rather than with bread. As her eggs are laid in hot weather, and as enough food must be stored in the cell with the egg to mature the young insect, the question is how to preserve the meat fresh for so long a time. She meets the difficulty thus: After a tube is finished except one end, which is left open, she flies off on a hunt for spiders. She finds a fat, healthy one, pounces upon it, stings it, and carries it off and places it in the mud cell. She repeats this process until she has placed as many spiders in the tube as, according to her judgment, will be needed. She then lays an egg in the cell and walls up the opening.

The remarkable thing about this performance is the magic effect of her sting. Whether it is the result of a subtle poison or whether it is

the special spot in the spider's nervous system where the sting is inserted we do not know. Certain it is that after being stung the spider lives on in a paralyzed condition for weeks and even months. It can move only slightly and remains helpless in its mud sepulcher until the wasp-egg hatches into a voracious grub, which at once falls to and eats with great relish the meat thus miraculously preserved.

Whether the wasp sting renders the spider insensible to pain or not is a question not yet settled. However, the chances are in favor of the theory that it does. Anyway we need waste no sympathy on the spider, the most bloodthirsty of all the little people of the fields and woods. There is a sense of retributive justice in the thought of a spider helpless and at the mercy of a small insect which it would have mercilessly devoured had it been able.

So we need not accuse our alert, industrious cement-maker of any unreasonable cruelty if she, like us, insists upon a meat diet for her young, nor need we have any fear of her sting, for she seldom uses it as a weapon of offense or defense.—"Insect Domestic Economy," by Anna Botsford Comstock, in the *Chautauquan* for June.

A Fire-Resisting Cement.

The new fire-resisting cement has lately been subjected to a careful test in Germany, and an official protocol has been issued concerning its behavior, which bears the signatures of several architects, engineers and other experts. The trial was conducted in a wooden house built for the purpose, the walls and roof of which, and an iron girder supporting the roof, were coated with an inch-thick layer of asbestic. The structure was partly filled and surrounded outside with a mass of shavings and wood chips soaked in petroleum, and the whole was set alight and allowed to burn for about three-quarters of an hour. The fierce conflagration was then extinguished by means of hose, when it was observed that the asbestic showed no sign of either cracking or peeling. When it was at length chipped off in various places, both the iron and wood of which the structure was composed were found perfectly intact. It may be mentioned here that the huge fireproof curtain which separated the stage from the auditorium at the late "greatest show on earth" at Olympia, London was coated with asbestic. The source of this new fire-proof compound has already been explained in our columns.—*Chambers' Journal*.

RECENT PATENTS.

Process of Polishing Marble.

Patent No. 601,668, issued April 5, 1898, to John M. Mueller, Jr., of Cincinnati, Ohio. Application filed August 10, 1895.

This invention relates to a process of dressing and polishing countersunk and irregular surfaces of marble and other stone.

The object is to permit of a rapid dressing and polishing of irregular surfaces by power-driving mechanism without injury to the surface due to the heat developed from the friction of the parts, causing what is technically known as "burn." The features of the invention will be more fully set forth in the description of the accompanying drawings, making a part of this

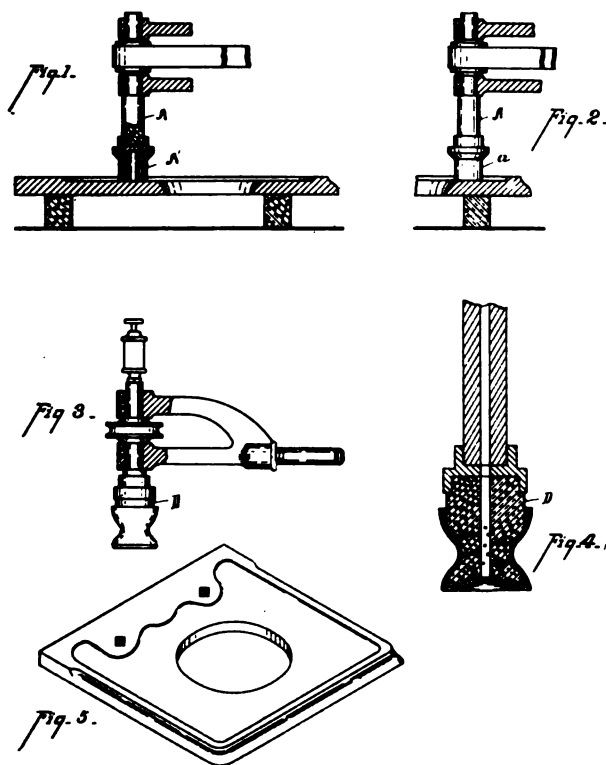
Fig. 2 is a similar view showing a device for effecting the finer grades of gritting and dressing. Fig. 3 is a side elevation of the polishing-spindle. Fig. 4 is an enlarged central vertical section of the same. Fig. 5 is a perspective view of a washstand-top showing the character of work to be accomplished.

Any well-known form of driving mechanism may be employed in the operation of this process, the preferred form being to mount the spindle upon a bracket and providing the same with universal joints, as shown in the accompanying drawings.

The process consists, preferably, of the following steps: First, after their regular counter-sunk surfaces have been produced by suitable tools

they are subjected to the action of a rapidly-revolving spindle A, Fig. 1, carrying a polishing-cylinder A', preferably of coarse emery, water being supplied in the usual manner to prevent the burning of the stone. This step removes the stone and tool-marks and leaves the marble in condition for the next grade of polishing. The second step consists in using in place of the emery-cylinder a wooden cylinder a, the end of the grain in contact with the stone, fine emery being fed upon the face of the stone from time to time and a limited supply of water being employed. The third step is similar to the second, except that powdered pumice-stone is substituted for the emery. In the fourth step a fine-grain stone or hone is substituted for the wooden cylinder, water being employed, and the work is given a velvet finish, preparing it for the final or polishing step. This step is effected by means of a wooden polishing-cylinder D, faced with felt or similar material. This polishing-cylinder is kept moist and supplied with oxalic acid, either in solution or dry. A small quantity of putty-powder is also employed and the parts of the stone to be polished are rubbed over with a small quantity of a suitable lubricating material to prevent the stone from becoming

burned. The polishing operation is continued a sufficient length of time to give the stone the finish required.



specification, in which—Figure 1 is a view, partly in vertical section, showing the manner of effecting the rough dressing of the stone.

Various attempts have hitherto been made to polish marble and similar surfaces with rapidly-driven power mechanism, all of which have failed owing to a tendency to develop heat and burn the surface to be polished. By the use of oil upon the surface with this invention one is enabled to use a rapidly-revolving buffer without danger of burning the surface or of the oil sinking into the surface, as it would ordi-

Rock-Channeling Machine.

Patent No. 599,732, issued March 1, 1898, to John McLean Reeves, of Bloomington, Indiana, assignor of one-half to George D. Hunter, of same place. Application filed October 14, 1897.

THIS invention relates to an improvement in rock-channeling machines, and particularly to the clamps employed in such machines for holding the drills or bits. Such

Fig. 1.

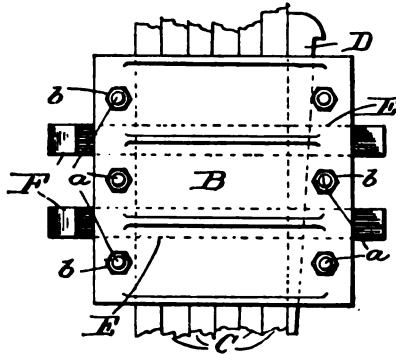


Fig. 2.

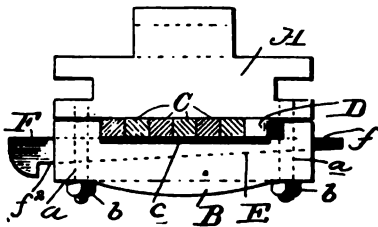


Fig. 3.

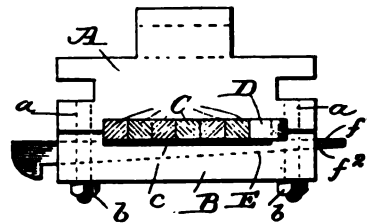
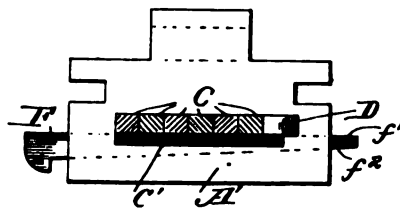


Fig. 4.



narily do, and the use of oil and suitable polishing materials applied with the buffer as the final step affords a finer finish it is claimed than has ever before been attained in marble-polishing.

clamps in the rock-channeling machines generally in use at the present time are constructed of two members, one secured to a reciprocating member of the machine, and the other, which constitutes what may be termed a "covering-

plate," secured to the first clamp member by a plurality of bolts. The drills, of which there are usually several in number, are arranged side by side in a space formed between the clamp members, and the bolts are relied upon for forcing the cover-plate against the drills to hold the latter in place. A vertical side wedge or key is driven between one of the end drills and the clamp to bind the several drills together. In the use of such machines, after the machine has cut a channel of, say, four inches, it is necessary to stop the machine to take up what is termed "the fall"—that is, the clamps are loosened and the drills lowered a distance about equal to the depth of channel already cut. To do this properly with the above-mentioned style of clamp is an operation requiring considerable time and causing great inconvenience, inasmuch as each of the bolt-nuts and the wedges must be loosened, the drills lowered, and each of the bolt-nuts independently tightened. Besides this inconvenience and loss of time it not infrequently happens that one or more of the bolts breaks or pulls out and requires to be replaced, thus causing further trouble and delay. It is to overcome these inconveniences, prevent loss of time in use, cheapen and strengthen the clamp, and generally simplify and improve the construction of drill-clamps that this invention is designed.

With such objects in view, this invention, generally speaking, consists of a clamp wherein the aligned drills are bound together by a suitable means, such as a vertical wedge or key at the side of one of the end drills, and all held rigidly in place in the clamp by a wedge or key or plurality of wedges or keys placed transversely or crosswise of the drills.

In the drawings, Figure 1 is an elevation of a clamp showing the drills in place. Fig. 2 is a top plan view thereof. Figs. 3 and 4 are plan views of slightly-modified forms of clamps.

Referring to the drawings, A, Figs. 1, 2, and 3, represent the fixed member of the clamp or holder, which is provided, as usual, with means for properly mounting it on the machine and maintaining it in proper position, which are common and need not be further described. To this part A are secured stud-bolts *a*, projecting outwardly from the face thereof. B, indicates the movable member or plate of the holder, provided with bolt-holes to receive the bolts *a*. *b*, are nuts working on the bolts *a*, and adapted to force the clamp members together. Between the adjacent faces of the clamp members, a space *c* is formed for the re-

ception of the drills C. This space may be formed, as in Fig. 2, by channeling or grooving the inner face of one plate, or, as shown in Fig. 3, the adjacent faces of each of the clamp members A and B may be provided with a shallow channel or groove, which, when the members are together form a space of proper width for the drills. This much of the clamp is old and not of this invention, which, it will be readily understood, is applicable to these known forms of clamps. D, is the usual side or edge wedge or key to bind the drills together. To apply this improvement to these clamps, there is provided in the movable plate B, one or more grooves or slots E, running transversely or crosswise of the drills, the bottom of said grooves being inclined, or, if desired, said groove may be formed in the part A, as is obvious. F, represents a wedge or key having a straight face *f*¹ and a face *f*² inclined similarly to the bottom of the groove E, said key being preferably made long enough to project out to either side of the clamp. This wedge when driven home in the slot impinges on one or more of the drills (according to conditions) and forces the latter against the holder with sufficient force to form a very efficient clamp.

In Fig. 4, is shown instead of the members A and B a single-part holder A', provided with a hole C' sufficiently wide to permit of the passage of the drill-points, which are somewhat wider than the drill-bodies.

In using this improved clamp it is simply necessary when it is decided to "take up the fall" to strike the cross-key F with a hammer to drive it out and then strike the side key D. This will loosen up the drills, the latter dropping of their own weight the required distance. Then to again clamp the drills the cross-key F is driven reasonably firm, after which the key D is driven home. The cross-key should then be given another stroke of the hammer to drive it home, when the drills will be properly held and the machine can be started. Thus it will be seen that the drills are more firmly clamped in much less time than when nuts or bolts are employed and have to be loosened and tightened individually.

It sometimes happens that the drills after usage wear to a certain extent, and thus become of different thicknesses. This, however, will not render the clamp ineffective on account of the cross-key not impinging on all of the drills, for the key D firmly binds all of the drills together, and as the cross-key F must necessarily impinge against one or more of the drills the whole row of drills is securely held.

BOOKS AND PERIODICALS.

"Torpedoes and Torpedo Boats" is the subject of the leading paper in the June number of Frank Leslie's Popular Monthly. B. B. Croffut tells the history and progress of these little engines of destruction, and describes their manufacture, cost and manipulation. The article would be interesting at any time, and is particularly so just now. It is liberally illustrated with views of short and long torpedoes, the principal torpedo boats of this and other countries, and interiors of a torpedo factory. Another timely article is one on "The Naval Militia," by Charles Sydney Clark, which describes the work and duties of this excellent auxiliary arm of our navy. The illustrations include portraits and groups, and views of some of the vessels manned by the naval militia. "The Working of a Modern Mine," by James Harold Thompson, tells of the life of the miners at work, and is well illustrated. The article on Andrew Jackson this month is by Old Hickory's grandson, Colonel Andrew Jackson, and gives some recollections of the general's home life. A pretty piece of music is contributed by John Philip Sousa, the "March King," the words to which were written by Hunter MacCulloch. The Disciples of Christ are described by Rev. S. T. Willis, with many good pictures. Henry Clay Colver has an interesting account of the resources of Seattle, Wash., which is illustrated with views of the principal buildings and points of interest. A new pen is apparently devoted to the department known as "The Leslie Portfolio," for the matter is much more attractive than before. There are numerous other good things, including several short stories, the department for boys and girls, etc.

"Veracity" is the title of a somewhat unusual essay by Prof. William H. Hudson, of Stanford University, which appears in Appletons' Popular Science Monthly for June. Professor Hudson shows that the persons to whom we lie most often are ourselves, and that in matters of conscience it is essential to truthfulness that we be ready to accept fact as fact, no matter how unpleasant it may seem to be.

In history-making times like these a truthful record of passing events becomes an imperative need. The daily newspaper is ephemeral and not easily preserved for reference. The American Monthly Review of Reviews has all the value of the newspapers, besides distinctive merits of its own. As an epitome of current history it is complete, compact, terse, impartial absolutely reliable, and judiciously edited. As a piece of journalistic history-writing what could be more brilliant or fascinating than the

May number of this publication, with its story of the Spanish-American war-crisis? Merely as a souvenir of this past eventful month the Review has a unique fitness.

The publishers of the Scientific American have issued a special number as a naval supplement containing nearly a hundred illustrations of the immense warships which are doing so splendidly the work of swiping the Spaniards from sea and shore. As everybody but bull-fighters are intensely interested in the action of American modern war vessels, manned by trained crews, and commanded by the best naval strategists on water, this publication is most timely. In our opinion it is the best of the lot of books of the navy so far issued. Price 25 cents. Address Munni & Co., 361 Broadway, New York.

"QUEER JANET," by Grace Le Baron, author of "The Rosebud Club," "Little Miss Faith," "Little Daughter," etc. Cloth; illustrated. Lee and Shepard, publishers, Boston.

Mrs. Upham here follows up her success in "The Hazelwood Stories," by "Queer Janet," which bids fair to be more attractive than her preceding work.

It is a case of "*cela va sans dire*" that Grace Le Baron loves the little ones, and her pen pictures them just as we know them; just as they are. "Queer Janet" is certainly an ideal character, but by no means an unreal one, and her beautifully unselfish life is the rare lesson of a little child who lives up to the Golden Rule.

Jerry Fitzpatrick is a real boy, as most boys are, but the ring of the true metal is there from the first moment that he entered Mrs. Gaston's house with his little sisters up to the time when he purloined Francois, the Count, in order to educate him for the cat contest, and we only wish we could have clapped our hands and shouted "Bravo" to the successful young tenor in the last chapter, and we are authorized to state that the charming little face which smiles at us on the cover was really and truly Grace Le Baron herself at the age of ten.

"Queer Janet" can be read by boys as well as girls with equal pleasure, and like the Hazelwood Stories—by the same author—we may venture to say that older readers too can derive an enjoyment from it not always found in juvenile stories.

"Mrs. Upham's books are rapidly growing in popular favor—a popularity well deserved, since there is not a page or a line in any of her writings which may not be read by the children, for whom they are chiefly written, with profit and delight." Price 75 cents.

The Chisholm & Moore Mfg. Co.

The Moore Mfg. Co., of Cleveland, O., formerly of Milwaukee, Wis., has changed its name to the "Chisholm & Moore Mfg. Co.," and has increased its capital stock to \$150,000. The company has bought 266x331 feet on the corner of Lake & Kirtland streets with switching facilities from the Pennsylvania Company, and is erecting a brick building with iron trussed slate roof, into which it expects to move about the first of August. Its business in chain hoists, cranes, trolleys, steel door hangers, etc., has increased very rapidly and has far outgrown its present quarters. The company is putting on the market an electric chain hoist for which there promises to be a large demand.

Clayton Air Compressor Works.

There can be no more convincing commentary upon the wide range of applications of compressed air power than the sales report of the Clayton Air Compressor Works, Havemeyer building, New York, for the month of February, March and April. In all, nineteen air compressors were sold for operating pneumatic stone tools, chipping and chalking tools, air hoists, etc.; nine air compressors for moving and elevating acid and chemical solutions; four air lift pumping plants were installed and placed in operation, three air compressors were furnished to rubber works for removing hose from mandrels, testing hose and inflating tires; one compressor was supplied for the pneumatic transmission of messages; two for oil burning plants; three for racking off beer in breweries; one for spraying brick in the process of manufacture; and six for unusual applications of compressed air power.

In addition to this number of air compressors furnished for domestic use, four were exported to Europe for operating pneumatic shop plants.

Among the orders of especial interest included in the above summary, may be mentioned the plant installed at the navy yard, Brooklyn, N. Y., for supplying pneumatic drills, paint machines and hammers, and one furnished to the Yarrow ship yard, London, for operating pneumatic tools. Another installation of interest is the compressor at the Dun building, New York, which supplies compressed air dusting nozzles for cleaning the iron grill work of the elevator shafts.

Among the orders now in hand is a large compressor for the Bath Iron Works, Bath, Me., to operate pneumatic tools.

SITUATIONS WANTED.

Advertisements under this heading inserted for subscribers to STONE free of charge. Advertiser must send 25 cents to pay postage, if replies are to be addressed in care of STONE. Rate to non-subscribers, 10 cents per line each insertion.

WANTED SITUATION—Cut stone foreman desires position. Is capable of taking charge of all kinds of stone-cutting machinery. Have had 16 years' experience in cut stone business. Can give references from last employer, who has retired from business. Address FOREMAN, care of STONE.

HELP WANTED—A good, sober and industrious marble polisher, can find steady work at fair pay, at ECKHARDT MONUMENTAL CO., Toledo, O.

HELP WANTED.

Advertisements under this heading 10 cents per line each insertion.

WANTED—To learn the whereabouts of William J. Barber, at one time in our employ as yard foreman. Address THE CULVER STONE CO., Springfield, Ill.

SITUATION WANTED—By first class man as foreman or draughtsman on cut stone work. Has had large experience; can give A1 references; sober. Address P. A. J., care of STONE.

TO SELL. TO BUY. TO EXCHANGE.

Advertisements inserted in this department for 15 cents per line each insertion.

MARBLE PROPERTY—Undeveloped. Fine gray and blue marble. Ideal water front and shipping point, mouth of Soo river on the great steamboat channel, 40 miles northeast of Mackinaw. Low freight, cheaply quarried. Rock bare; rising nicely from water's edge. Will give you a bargain on sale, lease or royalty. Your correspondence and investigation invited. W. B. HOUSE, De Tour, Mich.

FOR SALE—Wardwell Channeler, double cutter. Practically new. F. G. SWININGTON, Rutland, Vt.

FOR SALE—By order of Court. Complete brick making plant of W. C. Hill Estate now running at good profit, nineteen acres of land, one mile from postoffice, Seattle, Washington. Price, \$30,000. WILLIAM H. LEWIS, Administrator, P. O. Box 52, Seattle, Wash.

LIMESTONE QUARRY TO LEASE—An A No. 1 flux stone quarry, only 60 miles from Pittsburgh, Pa. Quarry nicely opened and side-tracked into the quarry a few rods from the main track of a most liberal railroad. Crushing machinery of 300 tons daily capacity; ready to set up. Stone can be sawed into dimension stone, crushed for flux or asphalt paving. Natural gas for a steam power can be had for a song. This is an excellent opportunity for a thorough quarryman with but small capital, as well as for the royalty; poor health reason for retiring. Correspondence solicited. Address H. W. SPOONER, Erie, Pa.

HOISTING ENGINES,

Locomotives, Relaying Rails, Air Compressors, Drills, Steam Pumps, Engines, Boilers, Stone Crushers, Etc.

NEW AND SECOND-HAND

THOS. P. CONARD,

119 So. Fourth St., Philadelphia, Pa.

QUARRY PUMPS.



CHEAPEST. HANDIEST. SIMPLEST. } PUMPS.

Handling Dirty, Gritty and Sandy Liquids, without Wear, Oil or Care. Pumping outfits for Contractors, Mining, Irrigating, Railroad, Quarry, Drainage and Manufacturing purposes. Second-hand Engines, Boilers, Pumps, and other Machinery always on hand. Exchanging.

MASLINS, 165-167 First St., Jersey City, N.J.

CONTRACT NEWS.

New Kensington, Pa.—The Methodist Congregation will erect either a brick or stone church. Cost \$15,000. Rev. A. E. Husted, pastor.

Minoa, N. Y.—The members of the Albany Street Church will erect a new edifice to cost about \$10,000. Pastor, J. C. Russum.

Chester, Pa.—Jas. McClermont, of Chester, Pa., is the architect for the \$50,000 limestone church for the First M. E. Church, of Chester, Pa.

Dallas, Tex.—The Congregation Emanuel have decided to build a new synagogue. The directions recommend that \$20,000 be expended. Seating capacity will be 500.

Wautoma, Wis.—A movement is now on foot by several prominent people of Waushara county to raise money to purchase a soldiers' monument to be placed in the Court-House square in the village.

Sidney, Ill., is taking practical steps looking to the erection of a soldiers' monument. The fund will be started with a patriotic concert May 30, and it is hoped to have the unveiling of the monument July 4. G. W. Clinkenbeard is secretary and W. P. Jones, treasurer.

Eikton, Md.—It is proposed to erect a monument in Cecil county to the memory of John A. Kay, son of A. B. Kay, of Rising Sun, who was a victim of the Maine disaster in Havana harbor.

Grove Church, of New Durham, N. J., will erect a monument to Peter Peters. The funds will be raised by subscription.

A chapel for Machpelah cemetery in Le Roy, N. Y., is to be erected in the near future.

Keokuk, Iowa.—The Y. M. C. A. have purchased a site for the erection of a new association building. No plans have yet been considered, but they will be received from now on and as soon as a decision is reached building operations will begin. Estimated cost of building \$25,000. A. E. Mabless, treasurer of building committee.

Pittsburg, Pa.—The directors of the United Presbyterian Theological Seminary have authorized plans to be prepared for a new building to cost \$75,000.

Indianapolis, Ind.—The Cincinnati, Hamilton & Dayton Railway is contemplating construction of new freight house here, cost \$100,000. The improvement, however, is wholly dependent upon the granting of a petition by the city authorities.

Scranton, Pa.—The Lackawanna Trust & Safe Deposit Co. have under consideration plans prepared by A. W. Fuller, of Albany, for the erection of a new bank building. It is proposed to erect the building on the present site and will be exclusively for banking purposes. J. W. Fowler, treasurer.

Savannah, Mo.—Andrew county will build a new jail and court house to cost \$70,000.

Galesburg, Ill.—The Library Board has accepted plans prepared by Gollschalk & Beadle for the new library. Inside arrangements have not been decided upon. The building may be made two story and three story, with a large lyceum hall on the top. Estimated cost \$37,000.

Sheboygan, Wis.—The first M. E. Society will erect a \$10,000 church.

Hillsdale, Mich.—The Hillsdale County Commissioners have accepted the plans prepared by Claire Allen, of Jackson, Mich., for the court house. The building will cost \$45,000.

Sharon Hill, Pa.—Architect, F. R. Watson, 1208 Chestnut St., Philadelphia, is making plans for a convent to be erected at Sharon Hill, for the Convent of the Holy Child Jesus. Cost \$40,000.

Jonesboro, Ark.—The M. E. Society has \$12,500 subscribed for the erection of a new church. Rev. Frank Barrett, pastor.

Indianapolis, Ind.—The Covenant Congregational Church has been organized with 135 members. A fine church will be erected.



SPIRAL

Sand Pump

For Feeding Sand Steel or Shot for

SAWING STONE.

Of all Kinds. Does More Sawing, Uses Less Sand and Water, Requires Less Power and Repairs than any other. Runs only 20 revolutions per minute Pays for itself in Six Months.

FRENIER & LeBLANC, Rutland, Vt.



THOMAS CARLIN'S SONS.

Allegheny, Pa.

Manufacturers of Hoisting Engines, Derricks of Steel or Wood, Contractor's Tools and Machinery.
Large Stock of Locomotives, Cars and Steam Shovels on hand.

Stone Workers'

FILES AND RASPS



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NEW YORK.

Arithmetic for Stone Dealers.

Calculations Made Easy,
Errors Avoided,
Time and Labor Saved by

Ropp's
COMMERCIAL
CALCULATOR.



The most useful, complete and practical work on Figures ever published. Specially useful to stone, marble, granite and slate dealers and quarrymen. Nearly every problem in business already figured out. Arithmetic made so plain by original, short and simple methods, that a child can comprehend it. Worth its weight in gold to young and old. Nearly half a million copies sold. Accompanied by account book, silicate slate, pocket, etc. Bound in elegant leather, pocket size. Address

THE D. H. RANCK PUB. CO., 358 Dearborn St., Chicago.

Sent by Mail on Receipt of Price, \$1.

"I like STONE and shall continue to take it."

—Wm. Middleton, Olneyville, R. I.



McKIERNAN DRILL CO.

120 Liberty Street, New York.

Works, Paterson, N. J.

Latest
Improvements in

Rock Drills

More efficient, more economical, and constructed of fewer parts than any other.

Air Compressors of the most modern design.
Quarrying Machinery.

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X

NOTES FROM QUARRY AND SHOP.

Zanesville, O.—William C. Townsend, an extensive dealer in and importer of marble and granite, and one of Zanesville's wealthiest and most influential citizens, died June 8, aged 55 years. He had been ill but two weeks. A widow and one child survive him.

The South Park Stone Company, with headquarters in Cleveland, O., but incorporated under the laws of Arizona, has given the Secretary of State notice of compliance with the laws of Ohio. The headquarters are at Tucson, Ariz. The incorporators are Francis J. Wing, Albert C. Bender, and Charles W. Stage, and their capital stock is \$100,000. They will carry on a general stone quarry business.

Indianapolis, Ind.—Samuel A. Hollensbee and others, engaged in the quarry business, have brought suit against the City Construction Company, the city comptroller and others to recover \$1,500 for curbstone and other material furnished to the company for the improvement of Sheldon street, which, it is alleged has never been paid for. The allegations as to insolvency, etc., are the same as those in the complaint of the Big Four company against the same defendants in a suit filed a month ago.

Barre, Vt.—The most disastrous fire ever known in Barre occurred just before midnight June 13, when Mackie, Hussey & Co.'s granite plant was totally destroyed. It was the second largest granite plant in New England, the loss being \$100,000; insurance, \$28,000. The fire is supposed to be the work of an incendiary.

Chicago.—The government engineers at the site of the federal building have completed an estimate of the work thus far completed on the foundation. In the pile-driving, 94 per cent. is completed; cement work, 80 per cent; masonry, 67 per cent. The eastern half has been completed, and the contractors are beginning to level the ground.

Johnstown, N. Y.—Anderson Brothers, marble; bill of sale; \$400.

Detroit.—John Oehlenbach and Thos. J. Heard have filed a chattel mortgage on property in their stone yard at Fort street east and Hastings street to Edward T. Adams, trustee of creditors, whose claims aggregate \$1,256.38.

Carthage, Mo.—The Viernow quarry in northwest Carthage has shut down pending the settlement of liabilities to the amount of \$10,-

682.80 against its owners, the Carthage Quarry & Construction Co. A deed of trust was filed June 6, conveying the property, machinery and all, including 9,000 feet of sawed stone, to Robt. L. McLaron, the company's legal adviser, of St. Louis. The trustee is authorized to sell the property to satisfy the debts. The creditors are G. M. Viernow, German-American Bank of St. Louis; M. F. Viernow, of Carthage; Carthage C. & C. Co., Keim & McMillan, O'Connor & Coughlin, of St. Louis; H. W. Elliott, and St. L. & S. F. Railway Co. The local stockholders expect to pay all obligations and resume operations within a few weeks. The trouble they allege, is due to internal rubs of some sort in the management, which can soon be adjusted.

Gates, Ore.—An unlimited deposit of gray granite has been discovered about nine miles east of here on the Corvallis & Eastern railroad. Engineers and experts have examined the rock, and pronounced it superior, to any yet found in Oregon, and equal, if not superior, to any from California, Washington or the Eastern States. The deposit is very large. One great ledge of the stone hangs almost over the track for a distance of a half or three-quarters of a mile, and the track cuts through the base of it. Millions of tons lie entirely exposed, towering over 200 feet high. Manager Stone, of the Corvallis and Eastern says that immediate steps will be taken to show that it can be readily furnished, should Oregon stone be selected for the custom-house soon to be built in Portland. Reliable men will at once take up the work. The deposit is located in the southwestern part of Marion county, on the west slope of the Cascade mountains.

Baltimore.—Edward C. Hartman, filed a bill in the Circuit Court against Adam Brandau, his partner in the marble business, asking for a receiver and a dissolution of the partnership, on account of irreconcilable differences between them. The firm was formed August 1, 1897, as Brandau & Hartman. An order was signed.

Rockland, Me.—Clark's Island, in the town of St. George, containing extensive and valuable granite properties, was sold to John Pierce, of Frankfort, by Mrs. M. H. St. John, of New York. Work was suspended temporarily, but it is understood that Sheenan & O'Brien, New York contractors will operate the property and put several hundred men at work there cutting paving. The property is valued at \$500,000.

*Mr. Thomas A. Edison
examines a "New In-
gersoll" Rock Drill.*

*An order for 8 additional Drills
is the result. Making 15 in all,
for his Works at Edison, N. J.*



THE "NEW INGERSOLL"

(WRITE FOR CIRCULAR.)

Air Compressors—Rock Drills—Coal Cutters

The Pohlé Air Lift Pump.

The Ingersoll-Sergeant Drill Co.,

HAVEMEYER BUILDING, N. Y.

Indianapolis, Ind.—A jury in the Superior Court brought a verdict for \$2,918 in favor of Thomas H. McConnell, in his suit against Martha E. Githens to collect payment for a monument over the grave of Mrs. Githens' husband in Crown Hill cemetery. The contract price of the monument was \$2,500. Before the monument was completed Mrs. Githens pointed out what she considered defects in the granite and refused to pay for it. The contractor went ahead, however, and then sued for the money. There was a good deal of "expert testimony" in the case.

New Haven, Conn.—Samuel Julian was given \$600 damages in his \$5,000 suit against the Stony Creek Red Granite Company.

Spokane, Wash.—Articles of incorporation of the North American Marble and Onyx Company were filed with the county auditor. The capital stock is to consist of 1,500,000 shares of a par value of 5 cents each. The incorporators are John Kaiser, George Kindorf and John H. Lutjen, of Valley. T. F. Conlan, Sebastian Haas, D. M. Drumheller, Pierce Jones, W. M. Ridpath and Eugene Denzel, of Spokane.

Frederick S. Douglas, president of the Rosendale Lime and Cement Company, of Newark, N. J., died at The Hague, Holland.

Franklin, Mass.—A. A. Rankin, the veteran marble and granite man, has sold his stock and business to the Greenfield Granite and Marble company.

Marietta, Ga.—The employes of the Kennesaw Marble Company recently showed themselves not only highly patriotic, but fully abreast of these stirring times of war. They had a flag raising at the mill about two miles above here under the shadow of old Kennesaw, where the forefathers of some of them made history in 1865. The pole when fastened to the top of the machinery building, gave a total elevation of about 90 feet. Besides the officers and employes a large number of citizens were present. The manager of the company, Mr. Geo. F. Newell, directed the program for the occasion, and the hearty manner in which the employes co-operated with him attested the high regard in which he is held by all and also the spirit of lofty patriotism that all felt.

North Adams, Mass.—This will prove a very busy season at the marble quarry as the company has secured a very large order, one that will take 22,000 cubic feet of marble to fill, says the *Herald*. It is to furnish the marble for a new court house for the appellate division of the supreme court of the state of New York. The order has been sought for a long time and the town in general will unite in congratulating the local company for its success in obtaining such a contract. The company is to put in new boiler and the capacity of the mill will be doubled. By the securing of this order a large force of men will be given employment. As all make good wages it will prove a great benefit to the town.

Greenwich Conn.—Familiarity with dynamite nearly caused Charles E. Griggs' death at his home near the Byram quarries. Three fulminate caps or dynamite exploders seriously wounded him and narrowly escaped killing his family. After arising early to attend some business, he returned to his bedroom to awaken his wife and daughter. As he leaned over the bed to speak to the latter, he rubbed against the sidebar of the bed, when there was an instant explosion, throwing him to the floor, and for a moment stunning him. The bed was broken down, and Griggs, realizing what had happened, went out to the barn, where his man was, and sent him for a physician. Griggs then returned to the house, and though in great pain told the neighbors who had arrived of the manner in which the accident had happened. He says in his vest pocket were three caps, each containing 60 pounds force, and sufficient to discharge a large amount of dynamite, besides a nail and a screw. When stooping over the bed the screw rubbed against the cap, it is supposed, setting it off and exploding the others. When the doctor arrived he found Mr. Griggs in a precarious condition, having a hole some eight inches in diameter and several inches deep in his side. He probed the wound and succeeded in removing portions of the shell and nails, his patient meanwhile looking on, unmindful of the severe pain which he must have endured. His intestines were bruised and the entire lower portion of his body in a bad shape from the concussion. It was thought that he could not live, but his condition is no worse. It was almost miraculous that the child escaped without any injury. The caps, when they exploded, seemed to divide their force, part going upward through Mr. Griggs' body and part downwards, and breaking a large piece out of the bedstead.

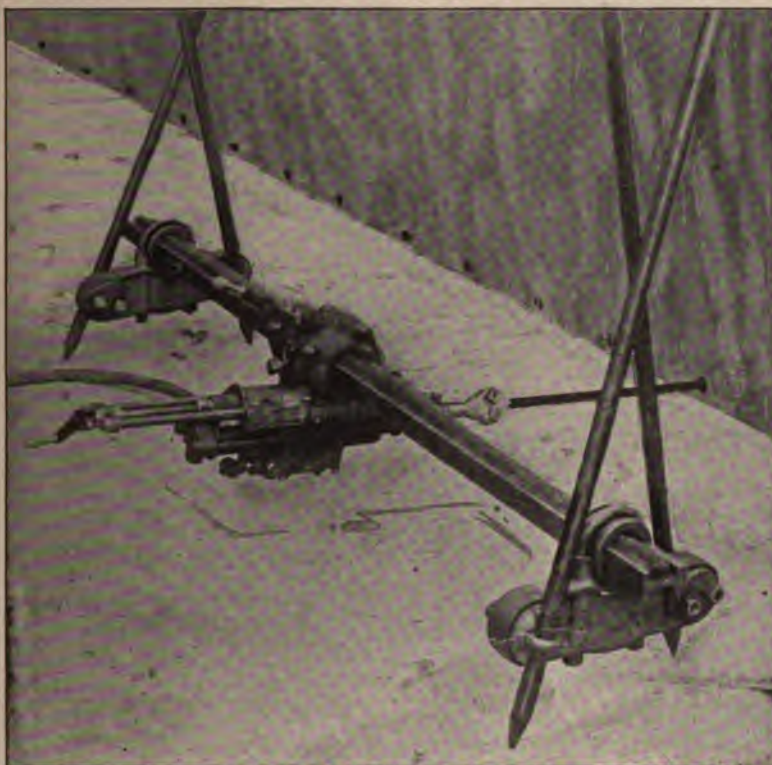
The output of the Cobleskill, N. Y., Stone Quarry is now three times as large as any in the state. Over 300 men are employed, and 100 more laborers are to be put on at once. The pay roll for April was \$11,000.

The stone-cutters at the Klondyke quarry at the railroad yard, Cobleskill, N. Y., were discharged on account of the union demanding the enforcement of the law which compels the employment of American citizens only on State and municipal work. The Cobleskill Quarry Company, which operates the Klondyke quarry, furnishes the stone for the new East River Bridge.

An unlimited deposit of gray granite has been discovered about nine miles east of Gates, Ore., on the Corvallis & Eastern Railroad. Engineers and experts have examined the rock, and pronounce it superior to any yet found in Oregon, and equal, if not superior, to any from California, Washington or the Eastern States. The deposit is very large. One great ledge of the stone hangs almost over the track for a distance of half or three-quarters of a mile, and the track cuts through the base of it. Millions

Sullivan Quarry Bars
Sullivan Gadders
Sullivan Rock Drills.

RAPID. STRONG. CONVENIENT.



THE SULLIVAN QUARRY BAR.

Channeling Machines for All Kinds of Work.

Contractors for

Prospecting Quarry Lands with Core Drills.

SULLIVAN MACHINERY CO.

Main Office, 54 to 60 N. Clinton St., CHICAGO. Eastern Office & Works, CLAREMONT, N. H.
339 Fifth Ave., PITTSBURGH, PA. 412 Seventeenth St., DENVER, COL.

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xii

of tons lie entirely exposed, towering over 200 feet high. Engineer Holcomb, in charge of the Government work at Yaquina, and a party of experts, examined the rock.

H. W. Loeffler and Edward Ruch, of Massillon, and George Lemmon, of Wheeling, W. Va., have leased the Stoolmiller farm near Warwick, O., and will proceed at once to open a large stone quarry. They have purchased the equipment used in the old Vogt quarry, north of Massillon, which will be moved at once. The new quarry will be connected by a switch with the G., A. & C. railway, and the location is convenient to Massillon, Barberton and Akron and less than a mile from the sand mill now owned and operated by Messrs. Loeffler and Ruch. The stone is white and of a superior quality, and suitable for all building purposes, and eventually the quarry will be one of the best in the State.

Keystone Cement Company of Borough of Brooklyn, New York City; capital stock, \$2,000. Directors, William C. Owen, John Kamelia and William H. Harris, of Brooklyn.

The Montello, Wis., Granite Company has incorporated with a capital stock of \$100,000.

Austin Portland Cement Manufacturing Co., of Austin, Tex. Capital stock \$50,000. Purpose, manufacture of cement and such material. Incorporators, E. G. Stolley, A. T. Rose and S. Silverman.

Waukesha, Wis.—A suit is on trial in the Circuit court, brought by William Joicks against the quarry firm of Blair & Larson, for damages alleged to have been sustained from a premature explosion while blasting at a quarry in the town of Menomonee. The plaintiff lost the sight of both eyes, and asks \$30,000 damages.

Dillon, Kan.—A new cement plaster company has been formed here to develop new beds of stucco in Marion county near Burns. A mill will be built at once. The directors are G. Heller, H. F. Brinkman, L. J. Kierfle, all of this place, E. W. Bonesteel of Peabody, and F. W. Kierfle of Lincolnville. The company has \$24,000 capital.

W. E. Hughes, the Clyde, O., monument manufacturer, has leased a quarry of colored marble at Rockmart, Ga. The marble is said to be very valuable.

Worcester, Mass.—Norcross Brothers have bought 15 acres of land at Glendale, Mass., through Engineer Coles, who, after a long test pronounces the stone in that hill to be fine marble. The reputation of the firm leads to the belief that they will open a quarry there soon.

The Albertson Marble company, whose quarry, mill and shops are located in Whipple Hollow, West Rutland, Vt., have been bought by parties in the interest of the Vermont Marble

company. This property consists of a quarry producing a very desirable quality of blue marble, a mill with twelve gangs and a finishing shop. It is the intention of the new owners to continue the operation of this plant in the same manner as heretofore for the present.

Clark Bros., of Urbana, Ill., have purchased the Berridge Marble works in Petersburg, Ind.

Wabash, Indiana—The Bolen Statuary works have been sold to Mr. Driebleiss, of Fort Wayne. It is not known whether the works will continue here or not.

Delphos, O.—J. G. Birkmeier, of this place, and Ign. Dabbelt, of Sebastian, O., have formed a partnership and will go into the marble business. The firm name will be styled Dabbelt & Birkmeier.

W. P. Rice, together with a number of Dayton capitalists are building a cement factory on the J. E. McAdams farm near Rushsylvania. The citizens of the town gave \$3,000 to get the concern.

A large deposit of marl has been discovered on C. W. Hartt's farm at Pierson, Mich. Parties interested in cement business will do well to investigate.

Baltimore, Md.—By consent, James Russell Carr was awarded \$100 damages as against the Schwind Quarry Company for injuries received in falling from a four-horse stone wagon. Carr is a six-year-old boy who was allowed by the driver to get on the team, but when he wanted to get off again, the driver would not stop, so he became frightened and fell off.

A well dressed man, who said he represented a railroad firm near Pittsburg, called at the quarries of the McCoy Lime Company, at Swedeland, Pa., and told a number of the quarrymen he would give them \$2.50 a day and pay their expenses to Pittsburg, providing they raised \$4.00 each. Eight men accepted the offer, accompanying the stranger to Philadelphia and gave him \$4.00 apiece. Pocketing the money he went ostensibly to purchase railroad tickets. He failed to return, and after waiting for an hour the quarrymen came to the conclusion that they had been duped, and returned to their homes.

The hum of industry is heard at Portage Entry, Mich., where this early in the season fully two hundred men are being furnished employment. Since March 1, the Portage Entry Quarries company has had 150 men engaged in stripping. It is believed the demand for red-stone has to some extent been interfered with, owing to the war, yet orders are coming in fast for this handsome building material, and a good summer business is assured.

Sheriff Fenicle will sell at public sale at his office in Easton, Pa., on Saturday, June 11, the property of the Bangor Central Slate company,

THE WARDWELL Steam Stone Channeling AND Quarrying Machine

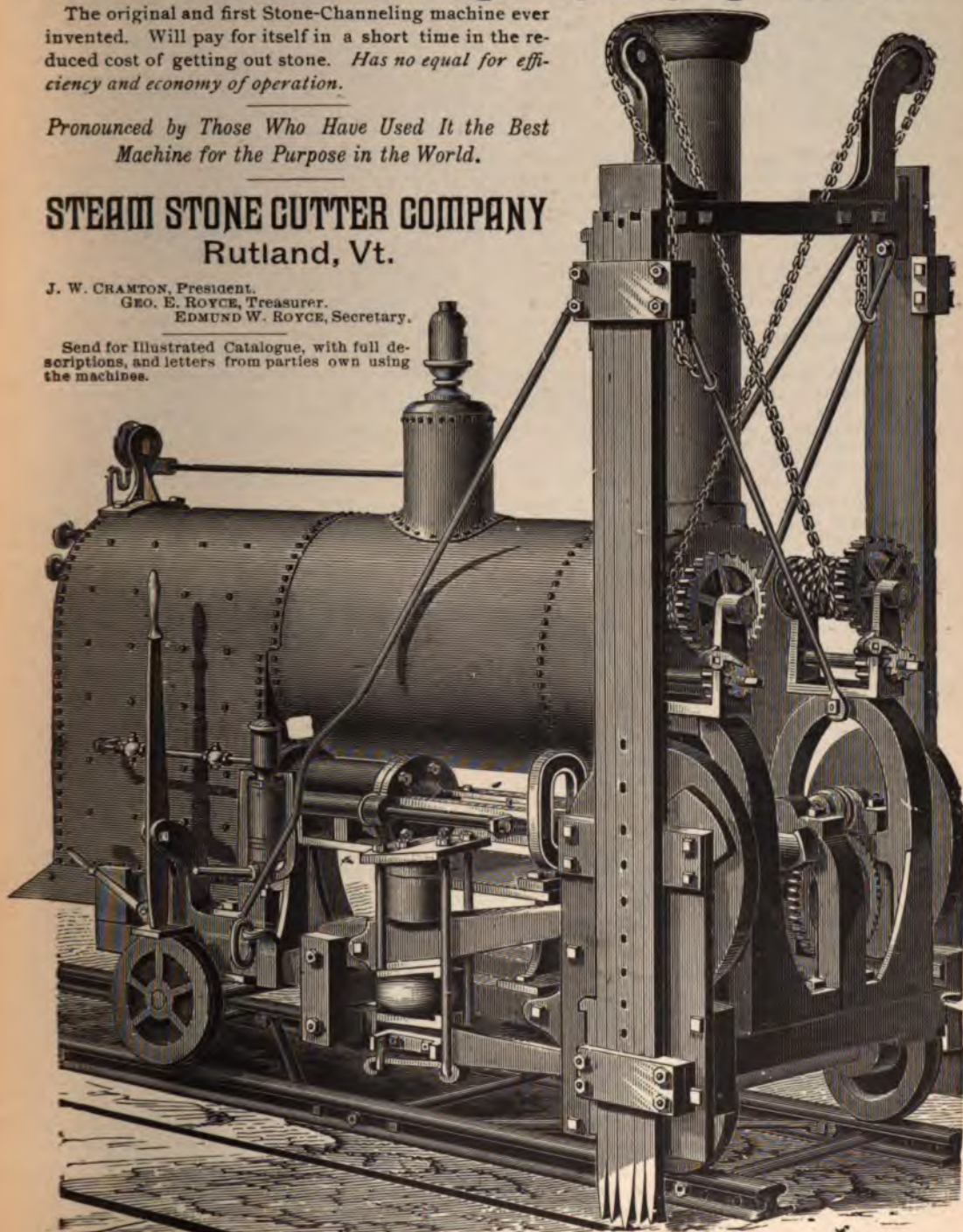
The original and first Stone-Channeling machine ever invented. Will pay for itself in a short time in the reduced cost of getting out stone. *Has no equal for efficiency and economy of operation.*

Pronounced by Those Who Have Used It the Best Machine for the Purpose in the World.

STEAM STONE CUTTER COMPANY
Rutland, Vt.

J. W. CRAMTON, President.
GEO. E. ROYCE, Treasurer.
EDMUND W. ROYCE, Secretary.

Send for Illustrated Catalogue, with full descriptions, and letters from parties own using the machines.



consisting of a quarry, with all the necessary buildings and machinery, on fifteen acres of land in the borough of Bangor. This is said to be one of the best quarries in the county and of course a desirable property.

William S. See, at one time a leading marble dealer in New York, died at the home of his son, in Paterson, N. J., May 28. He was 83 years of age, and until two weeks before his death enjoyed excellent health.

Samuel Jenks and his son William, proprietors of a stone quarry at Wabash, Ind., were instantly killed in that city while walking on the Wabash track by being struck by an express train.

St. Louis, Mo.—Cyrus H. Jones was appointed receiver for the Jefferson Stone Company, by Judge Fisher, on application of Nannie J. Loughran and Alfred Berkey. The receiver was required to give bond in the sum of \$10,000.

Kingston, N. Y.—All of the bluestone works employers who locked out their employes have agreed to open their works and pay union wages, with the exception of Osterhoudt, who has not yet agreed to the question of hours, and Sweeney, who has not yet come to an agreement with the cutters. The machine men and stone-cutters are supporting each other loyally, and all attempts to induce members of the one trade to sacrifice the other have failed.

Joliet, Ill.—The striking quarrymen held a meeting June 7, in this city and addresses were delivered by S. A. Wilson, secretary of the Chicago Federation of Labor; Peter Barthell of the Cigarmakers' union, and James Bearta, an Italian. These men urged the strikers to form a union to uphold their wages. At the close 250 men agreed to form a union and become enrolled in the American Federation of Labor. They elected officers and have applied for a charter. The quarrymen have been working for \$1.50 for ten hours and they now demand \$1.50 for eight hours, or \$1.75 for ten hours work.

Indianapolis, Ind.—The Western lime company was incorporated with a capital of \$100,000. The company will manufacture lime and cement, and will have its headquarters in Lawrence county, Indiana, and Cook county, Illinois.

Lancaster, N. H.—John H. Emerson has gone into the marble and granite business. He has associated with him Fred Emerson, who is a practical worker in both marble and granite.

The new \$50,000 statue of President Kruger, which is about to be erected at Pretoria, will be the first instance of any personage being represented either in marble or in bronze with a stovepipe hat on his head. The artist at first objected to the hat.

Mr. P. H. Haran, who owns one of the oldest and largest marble and granite works at Flatbush, N. Y., and who is first lieutenant of Com-

pany A, Sixty-ninth Regiment, has agreed to let his brother take charge of his work, and has volunteered to go to the war. Seven of his workmen have volunteered to follow their employer's footsteps.

The strike of the Machine Stone Workers' Union of New York City, which had been on for ten weeks, was declared off May 30, and about 10,000 men in various building rafts returned to work in about 125 buildings. At the same time the strike of the Hoisting Engineer's Union was also settled, the engineers agreeing to leave the board of walking delegates, not join any more sympathetic strikes, and signing an agreement for five years at \$5.00 per day for eight hours' work.

Exclusive of quarrymen, tool sharpeners and apprentices there are at present at work in Barre, Vt., 1,050 granite cutters, the largest number ever employed at any one time.

St. Louis proposes a monument to Thomas Jefferson, to be dedicated in 1903, when will occur the centennial of the purchase of Louisiana. The monument is to cost \$50,000.

The Hummelstown, Pa., brownstone quarries are running on ten hours time.

Springfield, Ohio.—Israel H. Kelly, monuments, reported to have given judgment for \$101.

Emmetsburg, Iowa.—Mugan & Fay, marble. S. W. Fay gave bill of sale for \$550.

Toledo, Ohio.—S. Clark, stone. Reported to have recorded chattel mortgage for \$778.

Shenandoah, Pa.—M. H. Master, marble. Reported to have given judgment for \$196.

Groton, Vt.—Webber & Anderson, granite. Reported to be in bankruptcy.

Indianapolis, Ind.—M. E. Humphreys & Co., slate and tin roofers, etc. Reported to have applied for receiver.

Mt. Vernon, Ill.—Graham G. Smith, marble. Reported to have given real estate mortgage for \$1,547.

Minneapolis, Minn.—Therien Cut Stone Co., Reported to have given judgment.

Utica, N. Y.—Frank E. Conley, stone, etc. Reported to have given judgments for \$6,039—sheriff in possession.

Cincinnati, O.—Charles McDonald, contractor and proprietor of the stone and marble yard in Sherman avenue, was obliged May 21, because of the pressure of creditors and dull business, to make a deed of assignment to M. T. Shine. His assets are estimated at \$25,000, and debts and liabilities at \$18,000. A preference by chattel mortgage for \$5,540 was given the Citizens' National Bank of Covington, and

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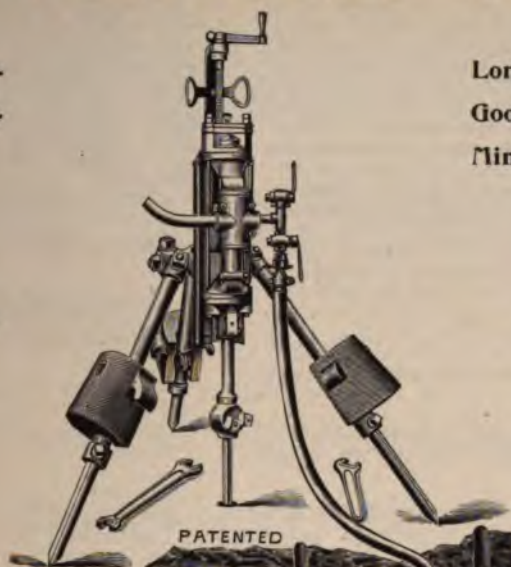
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one for \$1,994.02 to E. O. Prince and R. R. Flanagan. The assignee was authorized by Judge McNeill to continue the business.

Watertown, N. Y.—The personal property of the Davidson Marble Co. was sold at public auction under an execution issued in favor of S. A. Tolman of Chicago, who obtained a judgment of \$25,000 against the company by default. It was bid in by Mr. Tolman for \$1,300. The real estate will be sold later under another judgment.

St. Louis.—Richard H. Stevens began suit against the Jefferson Stone Company on a note for \$3,500.

Wilmington, O.—Wm. A. Harsha, marble. Reported to have given real estate mortgage for \$900.

Fitchburg, Mass.—Leary & Terrell, granite, reported to have recorded chattel mortgage for \$205.

Detroit, Mich.—The Adamantine Plaster Co., limited, reported to have given chattel mortgage renewal for \$1,400.

Minneapolis, Minn.—William J. Cribbee, paving contractor, reported to have given judgment for \$425.

Findlay, Ohio.—The West Park Lime & Stone Co., reported to have applied for receiver.

Philadelphia, Pa.—Joseph R. Connell, marble, reported to have given judgment for \$264.

Bedford, Ind.—The case of Fred D. Norton vs. The Peerless Stone Co. was decided at Bloomfield, May 28, the plaintiff recovering a judgment for \$9,290 and cost, and a foreclosure of a mortgage on the quarry and machinery of the Peerless Stone Co. The case was bitterly contested at every point, and has been pending for a year. It is probable that the defendants will appeal to the Supreme Court.

Dayton, O.—Thomas Staniland & Co., monuments, dissolved.

Springfield, O.—Pettigrew & Bro., stone and lime, succeeded by Ambrose Pettigrew.

Bird Island, Minn.—Thomas Minehan, of Green Isle, has purchased F. Poseley's interest in the Bird Island Marble Works, and will move here and take charge at once.

Detroit, Mich.—Alex. McDonald, well-known as a stone dealer, committed suicide by drowning.

Sullivan, Ind.—Wash French has purchased a half interest in the marble works of Pat McEnaney.

Booth Bros., and Hurricane Island Granite company, New York, have bought the quarry of the Waldoboro Granite Company located



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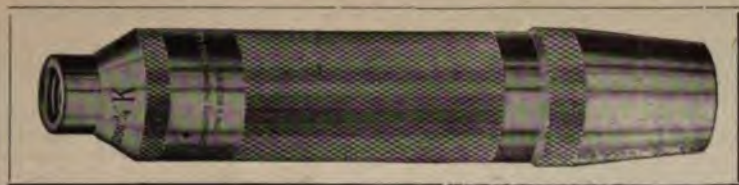
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about a mile above Waldoboro, Me. The Waldoboro Granite Company is a small corporation, and the quarry has not been worked for what there is in it. The purchasers will expend \$1,000 in getting the quarry ready to work.

Mankato, Minn.—The Mankato cement works has been transferred from Louis M. Fulton, of New York to Atwood Collins, of Hartford, Conn., as trustee for the first mortgage bondholders.

Rossville, Ill.—C. V. Trough has formed a partnership with Mr. McConnell, the gentleman to whom he sold his granite and marble works at Hoopeston last winter, and the style of the new firm is Trough and McConnell.

San Francisco.—The M. T. Carroll & Sons' Company was incorporated to deal in marble and granite. The capital stock is \$2,500, all of which has been subscribed by the following directors: Matthew J. Carroll, Luke M. Carroll, Christina Carroll, Mary E. Carroll and Katharine R. Carroll.

Rochester, N. Y.—The papers of incorporation of the Consolidated Wheatland Plaster Company were filed with the county clerk. The company is organized for "the purpose of grinding gypsum and other minerals." Its capital stock is \$50,000. The directors are John M. Horton, Charles Q. Freeman, B. L. Greider, E. N. Sprague and John Vaughn, all of whom live in Greater New York.

Occoquan, Va.—The Occoquan Co., has been incorporated with John L. Mayer, president; to purchase and operate stone quarries, etc. Capital stock \$200,000.

Knoxville, Tenn.—The Ross Marble Co., has been incorporated by John M. Ross, D. L. Ross, E. W. Eaton, F. S. Mead and James Maynard, to continue the operation of marble quarries.

New York.—The Logan Granite Co., has been incorporated by Robert Logan and others. Capital stock \$10,000.

Wheatland, N. Y.—The Consolidated Wheatland Plaster Co. has been incorporated by John M. Horton and others. Capital stock \$50,000.

Durham, Pa.—William White has opened up an extensive limestone quarry.

Albert Lea, Minn.—Subby & Son have established a granite and marble monument yard.

Warren, Ohio.—Toledo and Lima capitalists have organized the Elastic Plaster Co. and will erect a factory in Warren at once. John Pew is president, W. A. Coale, vice-president, and H. S. Pew, secretary and treasurer.

Pittsfield, Mass.—Berkshire building stone has attracted the attention of the leading builders in New York, and the Cleveland Stone Co., of Cleveland, O., with New York offices,

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has made a bid for some of the best stone in the south part of this county. This company has the option on four acres of stone on the highway between Glendale and Housatonic. The stone is owned by French, the New York sculptor, who bought it some time ago. The stone is on the right side of the road, about 150 feet below the Calender bridge, and is a ledge fully 100 feet high. The Cleveland company if they purchase will build a spur track from the Consolidated road across the river by the means of a trestle so that they can get out stone and run it across the river to load on the cars without re-handling. If the deal is made \$50,000 will be spent in developing the quarry.

Jas. Long, of Rockport, O., is making preparations to open his stone quarry, near Lipsett, O.

Elizabethtown, Ill.—M. S. Drake, of Metropolis, is prospecting and interviewing people in regard to starting marble works here.

Pen Argyl, Pa.—A party of capitalists with W. J. Turner, president of the Lehigh & New England railroad, at the head have taken a lease on part of the Davis property, west of town, and will open a slate quarry. A contract will shortly be awarded for the removal of 7,000 square yards on top, for an opening about 100x200 feet. The new company starts with a capital of \$40,000.

Anniston, Ala.—The Anniston Lime Company has been formed with Col. E. G. Eaton, of Gadsden, president. The main business office of the company will be located in Anniston in charge of L. C. Dickinson, the secretary and sales agent. The works of the company are located at Rock Spring, and are of the largest in the south, with a capacity of over 300 barrels of lime daily.

Allentown, Pa.—The Bonneville Cement Company has leased a hundred acre farm, and it will be developed for limestone for the extensive plant of the Bonnevilles at Rosdale.

Monticello, Ill.—Parties from Clinton are negotiating for a location for a stone and monument establishment.

Oregon, Wis.—Geo. Montgomery and Ed Dorr have opened up a stone quarry.

Cumberland, Md.—The Buckhorn Portland Cement Company will purchase a 1,000-acre tract on the Baltimore and Ohio, just west of Oakland, and will expend \$350,000 in the establishment of a plant of 1,000 barrels daily capacity. The tract also contains bituminous coal and silica. Philadelphia capital is largely interested.

New York.—Judge Lawrence, of the Supreme Court, has rendered a decision to appoint a receiver for the firm of Brown & Fleming, contractors, of No. 129 Broad street, in a suit

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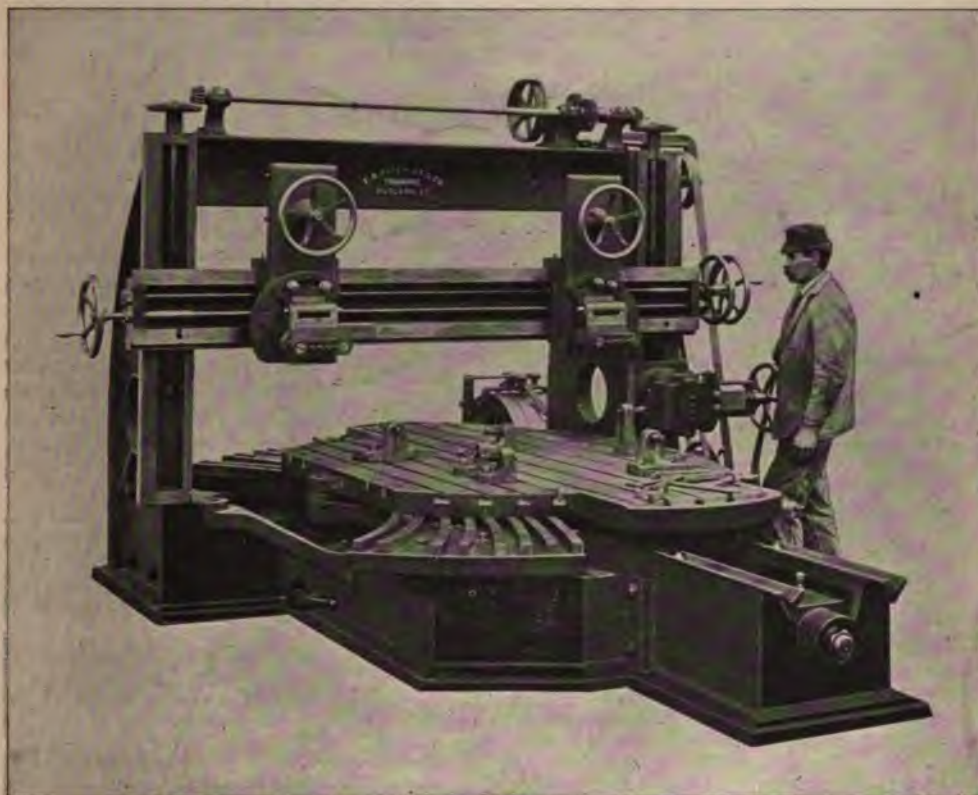
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brought by John Fleming against his partner, Charles Brown, for the dissolution of the partnership and accounting. The Judge is unwilling to appoint either partner receiver. If they can agree upon a proper party as such receiver the appointment will be made, otherwise the court will make the appointment, the bond of the receiver to be \$30,000. They have been in business together since 1880, did a large amount of work and have had large city contracts. They also have extensive crushed stone works at Verplancks, N. Y., where they employ 300 to 400 men. They now have outstanding contracts for crushed stone aggregating \$50,000. It is stated that the firm is perfectly solvent.

Newport, Vt.—The granite sheds at this place and West Charleston are closed, and the proprietor, J. M. Hazel, is out of town. It is not known why work is suspended, nor when operations will begin again.

Columbus, O.—The Columbus Slate Co., of which W. J. Keever is president, has increased its capital stock from \$5,000 to \$10,000.

Dauth & Deem, proprietors of the Reading granite quarry, at Mohnsville, Pa., have discovered a rich vein of garnet granite shooting under the hill at their premises. Mr. Dauth had a sample of it polished and tested and says that the grade is among the finest in the country. It will be suitable for monuments and can be also used for building purposes. They do not know as yet the extent of the vein, but believe that it will yield thousands of tons. They have been quarrying granite for paving and other purposes for some time.

Howe's Cave, N. Y., May 10.—The Cobleskill Stone Quarry Company, operating and owning one of the most extensive quarry plants in the state, suspended operations. Over 300 quarrymen and 100 stone-cutters were thrown out of work. They were quarrying stone for the new East River bridge, upon which work for the present has also been suspended owing to the decision of New York city's corporation counsel and comptroller that at this time it would require a larger expenditure of public money than the law allows. The contractors have taken the case into the courts and a decision is expected early in June.

Middletown, Conn.—The quarries companies have announced that business would be practically suspended for the present, or at least until some settlement of the present stone-cutters' strike in New York can be reached. The men will be paid off. Those occupying houses belonging to the company will be allowed to continue work at 14 cents an hour. The quarry companies regret that business will not warrant the employment of a full force, but the situation is such that they are forced to take the step. They have a large amount of stone on hand ready for shipment as soon as orders are received.

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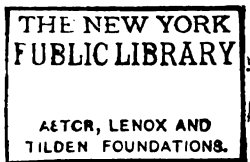
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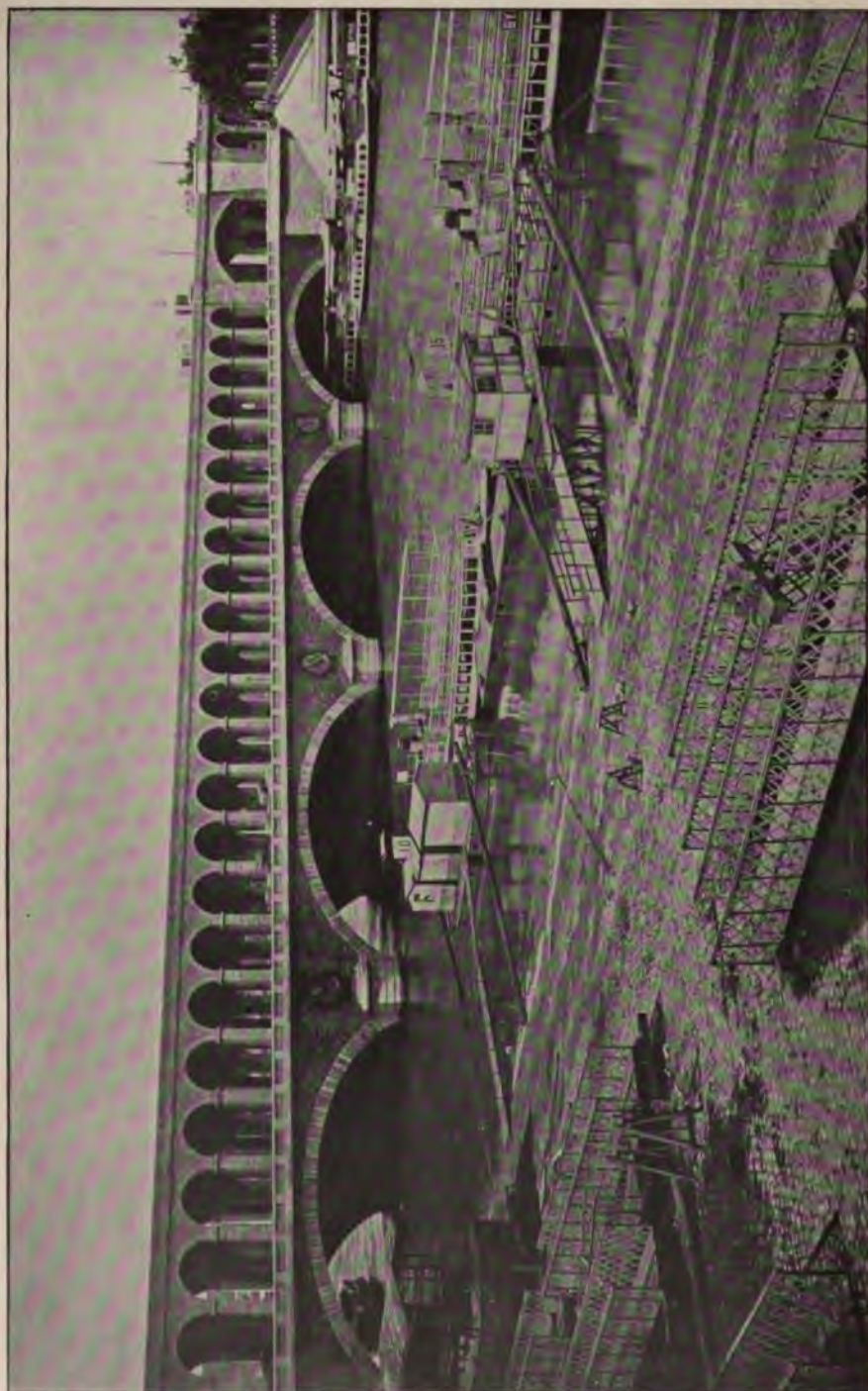
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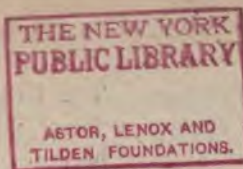
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STONE

VOLUME XVII.

JULY, 1898.

NUMBER 2.

THE SLATE REGIONS OF PENNSYLVANIA.*



THE average annual slate product of the United States is valued, in round numbers, at three million dollars; of this about sixty per cent. is produced in Pennsylvania, twenty per cent. in Vermont, six per cent. in Maine, and the remainder in California, Georgia, Maryland, New Jersey, New York and Virginia. Ninety per cent. of the entire product consists of roofing slate, the remainder being blackboards, school slates, mantels, steps, flooring, and sidewalk material.

The Peach Bottom slate of Pennsylvania and Maryland is supposed to have been formed in the early geologic period called the Cambrian. The Bangor, Pen Argyl, Lehigh and Hard Vein slates were formed in the Upper Silurian age, and are located in the particular divisions geologically known as Utica and Hudson. The outcrop of this in Pennsylvania is popularly known as the slate belt, although the workable beds of slate occupy but a small portion of its area.

THE PENNSYLVANIA SLATE BELT.

This area of slaty and shaly rock extends diagonally across the southeastern part of the state, having an average width of about ten miles. On the south it is bordered by the Silurian limestone, and on the north by the sandstone of the Blue Mountain, dipping to the northwest underneath the sandstone and above the limestone. On the map in Fig. 1 the shaded area shows this slate belt, and within it are indicated the four regions where marketable slate is produced. The Bangor region, the Pen Argyl region and the Lehigh region, which lie along the northern side of the slate belt, contain the softest slates, that have soft veins or ribbons. The Hard Vein region, which lies along the southern side of the slate belt yields slate with

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hard ribbons. The hard veined slates are older than the soft veined, as they occupy a lower position in the strata, and it is probably due to this that they have become of different structure.

The vertical thickness of the slate belt perpendicular to the dip is nearly



The Slate Regions of Pennsylvania.

FIG. 1.

6,000 feet, of which the soft veined division occupies about 1,500 feet. The marketable slate is found in veins or beds which are separated by rock of a worthless character. These veins are usually rolled and folded in a confused manner. The vertical section in Fig. 2, taken from the Report of the

Second Geological Survey of Pennsylvania, shows the rolling of the soft veins near Slatington in the Lehigh region. Each vein has usually a distinct character and is designated by a special name; moreover, it generally consists of several distinct beds separated by ribbons or by worthless rocky

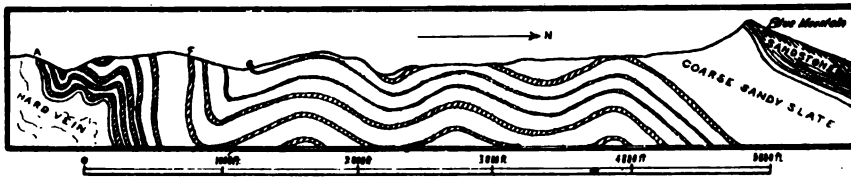


Fig. 2.
Slate Veins in the Lehigh Region.

material. These veins were originally in a horizontal position, being material deposited in a lake from the washings of the adjacent shores. When the deposit was made very slowly and consisted of fine clay, it formed the beds that subsequently hardened into roofing slate. At intervals storms caused thin deposits of organic material, which are now seen as ribbons, while in more violent and prolonged geologic changes the intermediate beds of sandy rock were formed. Subsequently occurred the violent upheavals which rolled the strata into their present form, and this was followed by a pressure which produced the property known as cleavage.

The cleavage of slate has no relation to the original stratification, but depends only on the direction of the pressure applied during the period of hardening, the cleavage planes being perpendicular to that direction. While the general dip of the rocks of the slate belt is toward the northwest, and while the general direction of the rolling veins and beds is also toward the northwest, the cleavage planes usually dip toward the south or southeast at varying angles, this being nearly horizontal in some localities, and as steep as 45 or 60 degrees in others. Thus it happens that the distance between two ribbons on the cleavage plane may be very different at different parts of the vein, although their distance apart when measured normal to the original strata is always the same.

STATISTICS OF THE REGIONS.

The following statistics for the year 1889, collected by Dr. William C.

REGION.	Number of Quarries	Number of Squares of Roofing Slate.	Total Value of Roofing Slate.	Total Value of Slate for other purposes.	Total Value of all slate produced.	Total Expenses of producing entire amount of slate.
Bangor.....	20	165,882	\$588,258	\$118,904	\$707,162	\$654,268
Pen Argyl.....	17	112,614	374,227	18,803	393,030	370,293
Lehigh.....	45	142,164	477,801	212,631	690,432	507,327
Hard Vein.....	18	45,974	160,149	24,446	184,595	177,695
Peach Bottom.....	9	31,068	142,255	4,310	146,565	105,024

Day, of the eleventh census, will give a comparative view of the amount of business in each of the Pennsylvania regions. It should be said that five out of the nine Peach Bottom quarries are in Maryland, although the larger part of this region lies in Pennsylvania.

On Fig. 1, a small slate area will be noticed in the sandstone formation east of Mauch Chunk. This is called the Aquanichicola area, and contains but two quarries whose product is very small. This slate is of dark color and it probably belongs to a later geologic period than the main slate belt; the statistics are included with those of the Lehigh region.

The order of commercial importance of the regions, as shown by the above table is as follows: (1) Bangor, (2) Lehigh, (3) Pen Argyl, (4) Hard Vein, and (5) Peach Bottom. If similar statistics were available for 1897 it would doubtless be found that the Lehigh region takes the first place, as it is known that its export trade has been greater in volume than that of the Bangor region.

The first slate produced in Pennsylvania was in the Peach Bottom region near Delta, where a church was roofed with it in 1805. The first regular quarry, however, was opened in 1812 at Mount Bethel, near Bangor. Prior to 1850 the production was very small, but soon after a rapid development began in the Bangor, Lehigh and Hard Vein regions, while that of the Pen Argyl region has almost entirely occurred since 1880.

THE BANGOR REGION.

The slate of this region is soft and tough; when free from ribbons it is generally of high quality and noted for its durability. The ribbons are almost black, while the slate itself is of the usual dark, bluish-gray color; the width of these on the surface of a slate is usually between one-half inch and two inches. If a slate has ribbons on one end only, so that they may be unexposed when laid on the roof, it is a second quality product; if it has ribbons on both ends it is of third quality. These ribbon slate are, of course, lower in price than the standard product of the region. Besides roofing slates this region also produces blackboards, school slates and mantels. The mantels are made to imitate dark colored marble by immersing them in an oily bath, heating them in kilns, and then rubbing until a polish is produced.

In opening a quarry a considerable part of the expense consists in stripping off the earth deposits and the weathered outcrop of rock. The slate is quarried by drilling holes at right angles to the cleavage and blasting out in large blocks. The quarry is usually carried down with very steep sides and the rubbish deposited in banks near by. At the Old Bangor quarry, which is the oldest and largest in this region, a different method of quarrying is adopted, it being worked in five benches, each about 15 feet high and from 30 to 40 feet wide, so that the width of the quarry at the top is nearly

200 feet greater than that at the bottom; thus the depth of the quarry remains constant at about 125 feet, while as the benches are worked downward a new one is being formed at the top.

The word Bangor was originally brought by the miners from Wales, and used in memory of that ancient and beautiful city which is six miles distant from the famous Welsh slate quarries. In every slate region there will be found either a Bangor village, or the word will be found prefixed or affixed to the name of one or more veins and quarries. The good quality of the slate of the Bangor region has tended to increase this custom, and the consequence has been that much slate of the Pen Argyl and Lehigh regions has been sold in the Western states under the name of Bangor. It will be seen by an examination of the records of tests given below that the slates of these three regions have a close family resemblance, so that it is difficult for one not an expert to discriminate between them, and hence the Bangor quarries have been forced to adopt the plan of selling carloads under the certificate plan. There is, however, one feature of Bangor slate which the author has not observed in those from any other region, namely, a peculiarity of the fracture produced in the cross-breaking or flexural text. Slate tested in this way will generally break squarely across, but the Bangor slate ruptures in different planes on the upper and lower surfaces, and usually splits horizontally into two thinner sheets; the structure is hence more laminated and fibrous than that of the Pen Argyl and Lehigh slates.

The headquarters of the Bangor region is, of course, at Bangor, which is a thriving town, having a population of about 3,500. It has direct railroad connections to Easton and Bethlehem, and also to Portland and Slatington. Most of the quarries have their offices at Bangor or East Bangor, but the offices of the largest concerns are at Bethlehem and Easton.

THE PEN ARGYL REGION.

The slate of this region is closely similar to Bangor slate, but it is generally not as soft and tough. The ribbons are black and soft, and do not appear in the first quality product. Almost the entire production is roofing slate. The quarries are merely excavations with very steep sides, most of the working being done at the bottom of the hole. The Albion quarry is the largest in size, its horizontal area being 300 by 500 feet and about 250 feet deep. Here, as also in the Bangor region, the quarrymen are divided into gangs of from six to twelve men, each gang having a contract with the quarry company to produce a certain amount of finished slate. The men furnish their own tools and powder, apportion the different parts of the work among themselves, and deliver the finished slates in the yard, the company hoisting the blocks out of the quarry and keeping it free from water.

The geologic position of the Pen Argyl slates is at the top of the soft veined slate beds, while that of the Bangor slates is at the bottom. This is

perhaps the reason why the two regions have received distinct names, since they are so near to each other that naturally they might be regarded as one region.

Pen Argyl, the headquarters of the region, is a town of recent growth, its population being 572 in 1880, and 2,108 in 1890, while now it is probably 3,000. It is on the Lehigh and Lackawanna railroad, which affords direct communication with Slatington and Bethlehem. Most of the quarries are near Pen Argyl, but a few are at West Bangor and at Wind Gap.

THE LEHIGH REGION.

This is the largest of the soft vein slate regions in area. The beds are geologically the same as those of the Bangor and Pen Argyl regions and the slate is similar in character. Few slate containing ribbons are produced, however, as the quality of these has been found to be quite inferior. Besides roofing slate it produces blackboards of excellent quality; some of the beds are so thick that blackboards six or eight feet in length may be made which are entirely free from ribbons. These are split a little thicker than the required thickness, planed or scraped upon a horizontal revolving rubbing bed and then finished by hand rubbing.



FIG. 3.—SLATE QUARRY, NEAR SLATINGTON, PA.

The majority of the quarries are merely surface holes with almost vertical sides, out of which the blocks are hoisted to be split on the banks. In several instances, however, vertical shafts have been sunk and tunnels driven through the rock to intercept the slate beds. Fig. 3 shows the entrance to one of these, and on it may be clearly observed the ribbons and laminations of the original stratifications as also the cleavage planes which here have a high inclination to the horizontal.

The sequence of the slate veins in this region has been made out more fully than elsewhere, and Fig. 2 gives a general idea of the manner in which they are found near Slatington. The section is taken looking westward, so that the Blue Mountain appears on the right. Between A and G is seen almost the entire thickness of the soft veined slate outcroppings on the surface. The shaded areas are the slate veins, each of these being subdivided by slaty rock and by ribbons into thinner beds; thus the Franklin vein, marked F, is thirty-five feet thick, and contains two veins of slate, thirteen and ten feet in thickness, which are separated by twelve feet of worthless rock. The direction of the shade lines in the different veins gives a rough indication of the direction of the cleavage planes, and shows how this is independent of the original stratification.

Slatington, a town of 3,500 people on the west bank of the Lehigh river, is the headquarters from which the greater part of the slate is shipped via the Lehigh Valley railroad. Of the fifty or more quarries in this region only about ten are east of the river, the shipping point for most of these being Walnport on the Central railroad of New Jersey. The Lehigh region, since the fall of 1896, has been active in supplying the demands of the European trade; while prices have been low the demand has fortunately been for the larger sizes, on which the best profits are generally realized.

THE HARD VEIN REGION.

The map in Fig. 1 shows that this region extends from the Delaware to the Lehigh river along the southern side of the slate formation. The slate is harder than that of the three regions described above; the ribbons especially are much harder and lighter in color, and are not liable to disintegration, so that the quality of the roofing slate is not affected by their presence, although they are objectionable in blackboards. In roofing with soft veined slates the slater easily drives his nails through them, but with the hard veined material this must be done with care to prevent cracking; for this reason holes are sometimes drilled at the proper place, and slates having these holes are frequently prepared at the quarries.

Steps, railings, flooring and sidewalk material are also manufactured from the hard veined slate. These are sawed by both circular and reciprocating saws. Fig. 4 shows one of the diamond saws used in the factory at Chapman's. After being sawed the larger surfaces are planed, and they



FIG. 4.—DIAMOND SAW IN THE HARD VEIN REGION.



FIG. 5.—SLATE SCHOOL HOUSE AT CHAPMAN'S QUARRIES.

may be rubbed so as to give the required finish. Fence posts of slate are frequently seen near the quarries, and of course even the humblest structure has its slate roof. Houses and shops are also often made of slate blocks. The picturesque building shown in Fig. 5 is the substantial school house at Chapman's. It will be noted that a few of the blocks are of dark color; these surfaces are where the slate has been split along the grain, the light colored surfaces being those cut under the saw.

The Hard Vein region has no special headquarters, it being crossed by several railroads so that the slate goes to market by different routes. There are a few quarries on the Lehigh river below Slatington, but the principal ones are at Chapman's and Belfast. The slate from Chapman's goes by the Lehigh and Lackawanna railroad to Bethlehem; that from Belfast goes by the Easton and Northern railroad to Easton.

THE PEACH BOTTOM REGION.

The four regions described above are classed geologically as Silurian, while the Peach Bottom slate is probably of Cambrian origin. It occurs associated with chloritic shists and is entirely free from ribbons, as the planes of stratification coincide with the cleavage. It is readily distinguished from the other Pennsylvania slates by its more lustrous color and by its slightly unctuous feeling. The area shown upon the map is somewhat wider than the actual slate formation, which appears to be a vertical dyke between the chloritic rocks.

The slate is of excellent quality as the tests detailed below fully show. It does not, however, split quite as easily as the Silurian kinds, and hence it is necessary to make the roofing slates of greater thickness. This involves greater strength in the roof boards to carry the additional weight, and moreover the price of the slate per square is about twenty-five per cent. greater than that of the other Pennsylvania kinds. For first-class work, however, this additional expense may be fully justified by the greater durability of the Peach Bottom slate.

The headquarters of this region is at Delta, a village of about 1,000 people, the southern terminus of the Peach Bottom railroad, over which the slate goes to market by the way of York. The quarries now worked have been opened and developed since 1850; they are all open pits of various depths between 100 and 200 feet.

PHYSICAL PROPERTIES OF ROOFING SLATES.

The natural color of all the slates of Pennsylvania is a dark bluish-gray, but the hard veined slates are slightly lighter in color than the soft veined ones. The ribbons of the soft veined slate are black, but those of the hard veined material are rather lighter in color than the slate itself. The color of the Peach Bottom slates verges on a bluish-purple when viewed in sunlight. Nothing can be inferred regarding the quality of the slate by

its color, except in regard to black ribbons, and these are not included in the standard product.

Quarrymen and slaters judge of the quality of roofing slate by its ring, a piece being balanced horizontally on three fingers and struck a blow near the edge. The better the slate the clearer and more metallic is the ring. This test requires much experience in order to be sure of the value of its indications, and probably its importance has been much overrated.

Numerous tests on the strength and weathering qualities of slate have been made in the civil engineering laboratory of Lehigh University since 1891. Some of those on the roofing slates of Bangor, Pen Argyl and Peach Bottom regions have been described and discussed in the Transactions of the American Society of Civil Engineers for September, 1892, and December, 1894. These tests have been conducted so as to determine those physical properties which, on the one hand, are conducive and on the other hand opposed to durability. Of the positive properties strength and toughness are important as indicating the ability to resist stresses and deformations, while resilience is the property of withstanding the action of shocks and blows. Specific gravity is also a positive property, for it is a general rule that the strength of any material increases with its density. Softness has also been proved to be a positive quality in soft veined slate, for the results of all the tests show that the softer the slate the tougher and stronger it is.

The negative properties which are opposed to durability are porosity and corrodibility. The more porous a slate the less is its strength and resilience, and the more easily it is liable to disintegrate under the action of the weather. As for corrodibility, or the liability to disintegrate under the action of sulphurous vapors in the atmosphere, this, of course, is a property which above all others is undesirable. On old slate roofs this corrosion is often indicated by the change in color which accompanies the disintegration, the natural blue becoming a grayish white.

Below will be found synopses of the results of these tests on the physical properties of roofing slates of Pennsylvania. In each case these are arranged so that the slates of the different regions may be compared, and so that the maximum and minimum results, as well as the mean, may be known.

SPECIFIC GRAVITY.

The mean specific gravity of slate from the main Pennsylvania belt is 2.775, which corresponds to 173.2 pounds per cubic foot. The Peach Bottom slate, however, is much heavier, its mean specific gravity being 2.894, and its weight being 180.6 pounds per cubic foot. The following shows the results of tests from each region, and judging from this quality alone it may be said that Peach Bottom and Bangor stand highest in rank.

REGION.	Number of Specimens.	SPECIFIC GRAVITY.		
		Minimum.	Mean.	Maximum.
Bangor.....	12	2.754	2.780	2.816
Pen Argyl.....	24	2.722	2.772	2.808
Lehigh.....	12	2.763	2.771	2.776
Hard Vein.....	6	2.754	2.776	2.790
Peach Bottom.....	12	2.858	2.894	2.918

SOFTNESS.

In 1892 the author discovered a relation between the softness of slate, as shown by abrasion on a grindstone, and its strength and weathering qualities, the softer slate being the better in quality. This law has been established only for the soft veined slates where it applies in comparing different quarries and particularly in comparing different specimens from the same quarry, but it cannot be used to compare hard veined slates with those of other regions. The following table gives

REGION.	Number of specimens.	RELATIVE SOFTNESS.		
		Minimum.	Mean.	Maximum.
Bangor.....	12	76	128	184
Pen Argyl.....	24	54	79	130
Lehigh.....	12	59	70	91
Hard Vein.....	8	42	47	54
Peach Bottom.....	12	53	90	177

the results of tests made on the same stone under identical conditions as to pressure and number of turns, the figures showing the relative weight abraded. Unfortunately this test cannot give absolute figures, since different grindstones vary in abrading capacity, so that the tests of different experiments cannot be compared.

FLEXURAL STRENGTH.

The most satisfactory method of determining the strength of roofing slate is by the cross-breaking test, a piece of slate being supported near its ends, and broken by a load applied half way between the supports. From this breaking load and the dimensions of the specimen the modulus of rupture of the material is computed, this being a quantity intermediate between the ultimate tensile and compressive strengths. The modulus of rupture is expressed in pounds per square inch, and is a very convenient measure of the ultimate strength of roofing slate. The following table gives values

REGION.	Number of Specimens.	MODULUS OF RUPTURE. Pounds per square inch.		
		Minimum.	Mean.	Maximum.
Bangor.....	12	7,280	9,810	11,570
Pen Argyl.....	24	5,010	7,140	9,110
Lehigh.....	11	6,120	10,630	15,170
Hard Vein.....	6	8,010	9,730	10,910
Peach Bottom.....	12	8,320	11,260	14,210

found for a number of specimens from the different regions. It is seen that the Peach Bottom and Lehigh slates have the highest strength, these being closely followed by the Bangor and Hard Vein specimens. The strength estimated by this method is that of static resistance, the load being applied slowly and without shock.

TOUGHNESS AND RESILIENCE.

The toughness of roofing slate may be estimated by comparing the deflections of pieces under the central breaking load, but this requires, in order to make comparisons, that all specimens should be of the same size. A more satisfactory method of comparing the toughness of different specimens is by means of the resistance offered to the impact of a falling weight, this resistance indeed being proportional to the product of deflection and strength.

Resilience is measured by the amount of work required to produce rupture, and the method adopted by the author as a practical test for slate consists in dropping a wooden ball upon a piece. The weight of the ball multiplied by the height of the fall, multiplied by the number of blows gives the work required for rupture, and this divided by the weight of the specimen furnishes the number of foot pounds of work per pound of slate, which expresses the dynamic resilience. The results shown in the table indicate that Peach Bottom slate takes the

REGION.	Number of Specimens.	DYNAMIC RESILIENCE. Foot-pounds of work per pound of slate.		
		Minimum.	Mean.	Maximum.
Bangor	9	1.7	4.8	7.4
Pen Argyl.....	10	2.6	4.1	5.7
Lehigh	12	1.1	3.9	6.9
Hard Vein.....	9	3.6	5.6	7.6
Peach Bottom.....	10	3.9	16.3	39.3

highest rank in regard to resistance from shock while Hard Vein stands next.

POROSITY.

The porosity of slate is measured by the percentage of water that it will absorb under given conditions. The more porous a slate the poorer is the quality, other things being equal, and in specimens from the same quarry it has been found that the strongest slate has the least porosity. The following results were derived after an immersion of 24 hours in water, the specimens being first dried for twenty-four hours at a temperature of 135 degrees Fahrenheit. With respect to porosity, therefore, it appears that Bangor and Hard Vein slates have the highest resistance to the absorption of water.

REGION.	Number of Specimens.	POROSITY.		
		Percent of water absorbed in 24 hours.		
		Minimum.	Mean	Maximum.
Bangor.....	12	0.099	0.145	0.204
Pen Argyl.	24	0.141	0.237	0.313
Lehigh.....	14	0.194	0.367	0.529
Hard Vein.....	8	0.099	0.180	0.238
Peach Bottom.....	12	0.143	0.224	0.304

CORRODIBILITY.

The corrosion produced in slate by the smoke and sulphurous vapors in the atmosphere may be imitated by immersing specimens in an acid solution and noting the percentage of weight lost in a given time. The solution used consisted of one part of hydrochloric acid, one part of sulphuric acid, and ninety-eight parts of water, by weight, and the time of immersion

REGION.	Number of Specimens	CORRODIBILITY.		
		Percentage of weight lost in 63 hours		
		Minimum.	Mean.	Maximum.
Bangor.....	7	0.374	0.446	0.551
Pen Argyl.	15	0.438	0.665	0.880
Lehigh.....	8	0.269	0.507	0.651
Hard Vein.....	8	0.108	0.302	0.481
Peach Bottom.....	11	0.150	0.226	0.341

of the specimens was sixty-three hours. The table shows the percentage of weight found by this method for small specimens having about ten square inches of total surface, and the mean results indicate that Peach Bottom and Hard Vein stand highest in capacity to resist corrosion.

CONCLUSION.

The preceding remarks and figures show the general characteristics of the slates of the five Pennsylvania regions. It should be noted, however, that the specimens for testing were taken from the best quarries of the respective districts, and that hence much slate found in the market may fail to reach the standards which the figures represent. While the results indicate, on the whole, that Peach Bottom, Bangor and Hard Vein are the best slates, it by no means follows that every quarry in these regions furnishes good slate. Indeed it is true that the best slate of the Pen Argyl and Lehigh regions may be much better than that of many quarries in the other regions. In selecting slate, as in selecting stone, the reputation of the quarry and the behavior of its product after years of service, are the best guides. The test of actual use is one that requires many years for its completion, and unfortunately statistics of such service have not been kept.

In addition to the above tests the author has also made a number of

severe corrosion experiments extending over a period of fifteen days. These indicate that corrosion increases proportional to the time of exposure to acid, and further that the less the corrosion the greater is the resistance of the slate in the impact test. The testing of roofing slate by the impact of a falling weight is one that may, perhaps, after further trial and study, be found available for practical use at quarries and slate yards, and the author hopes to be able to give it further attention with this end in view.

Mansfield Merriman,

Professor of Civil Engineering in Lehigh University.

South Bethlehem, Pa., June, 1898.

THE AUTEIL VIADUCT.*

TO no country can the engineer turn for the study of bridge architecture with the same degree of satisfaction as to France. The easily discerned cause for this was the early organization of the *Ecole de Pont et Chaussées*, which instituted a system in the engineering endeavor of France.

The greatest perfection has been attained in the bridges across the Seine at Paris, where naturally the expenditure has been most lavish in the direction of architecture. The Auteil viaduct crosses the Seine with five large arch spans, five of which can be seen in the view. The piers are of beautiful design and appropriately coped, while the arch ring is accentuated; the only possible fault being the concealment of the springing. The ornamentation of the spandrel filling, above the pier, with the imperial "N," adds much to the design; the coping course, supported by corbels, is surmounted by an elegant balustrade. This story carries a roadway, while the viaduct proper is carried above on thirty-one small arches, the supporting piers being pierced with two arches crosswise. A balustrade, in entire harmony with the one on the first story, surmounts the whole structure, while the connection with the approaches is effected by a very flat segmental arch on each side.

The unquestioned elegance of the viaduct, was not attained by the employment of any details except those absolutely necessary for the structural execution of the work, nor could anything further be added without detracting from its finished appearance.

"F."

*Subject of Frontispiece.

THE MOUNT WALDO INCLINED CABLE RAILWAY.



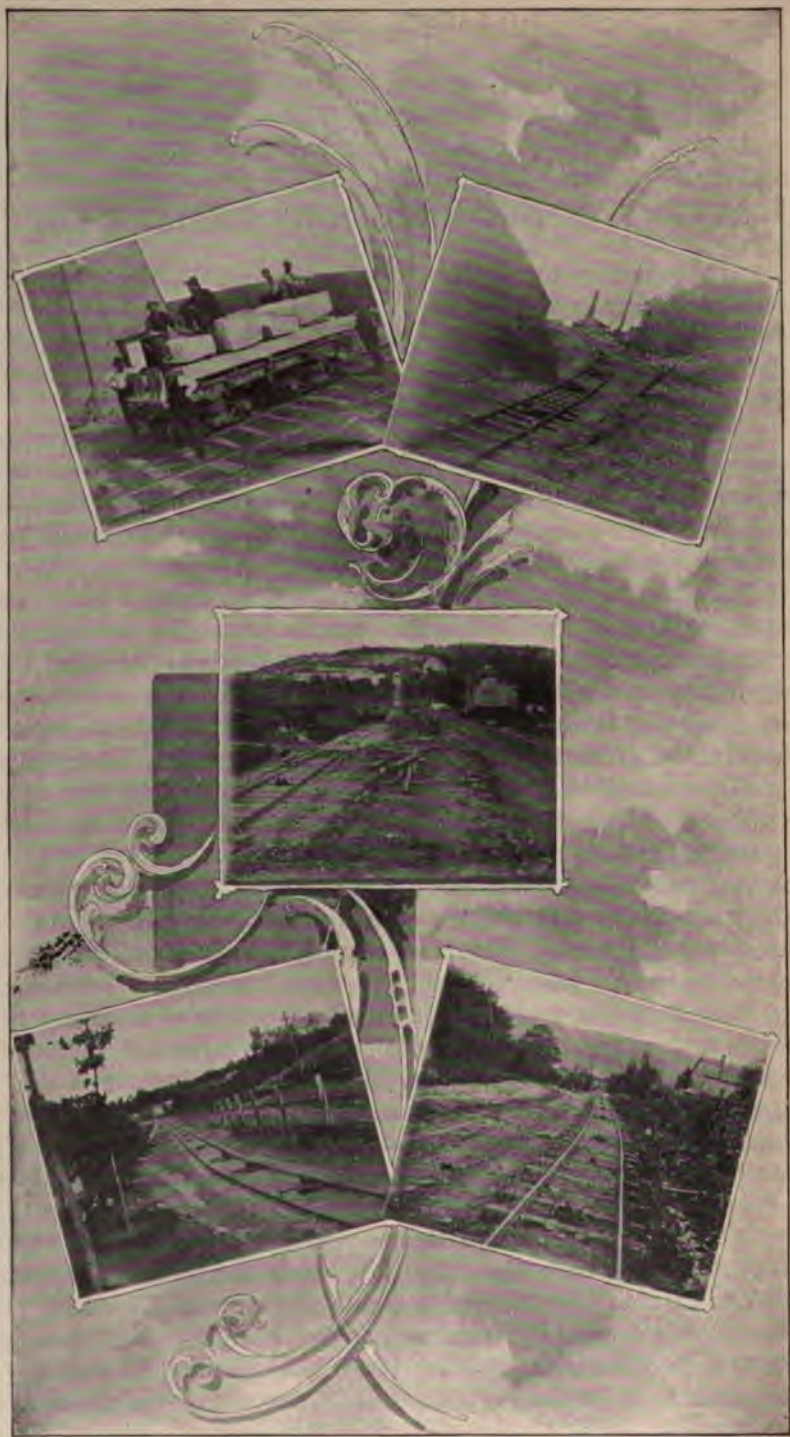
It not infrequently occurs that deposits of minerals, ores and building stones are situated at points inaccessible, or nearly so, to shipping facilities, so that the larger portion of the cost of production is chargeable to the handling of the material within the very precincts of the field of operation itself.

This state of affairs seems to be almost inherent to the development of the resources of the United States, as though Nature had demanded an exchange for the bounties she has lavished with so free a hand, the highest development of skill and ingenuity in man himself, in order to profit by the priceless riches laid at his feet.

The American, foreign and native born, has approached the problems presented with zeal and ingenuity which rival the resourcefulness of Nature herself. The conveying of heavy loads across rivers and valleys and down mountain sides, and numberless other exploits of this nature, without the expenditure of large sums for costly installations, have been successfully and economically accomplished. There are, however, from time to time, questions which, notwithstanding the difficult feats of engineering that have blazed the way for so many sets of conditions, baffle the mine manager or quarry superintendent.

Among these problems one which has just been transferred to the right side of the account of engineering is the Inclined Cable Railway at the Mt. Waldo Granite Quarries, Frankfort, Maine. This plant was recently erected by the firm of John A. Roebling's Sons Company, of Trenton, New Jersey. The Roeblings have figured prominently both as manufacturers of wire ropes, etc., and as engineers and contractors of large and small suspension bridges, haulage plants and the like. They celebrate this year the fiftieth anniversary of the establishment of their works at Trenton, New Jersey, although their business dates back to an earlier period, when John A. Roebling commenced the manufacture of wire and wire ropes at Saxonburg, Pennsylvania, in 1840.

The Mt. Waldo quarries are located about a mile from the wharf at Frankfort, Maine, and are about 360 feet above the level of the shipping point. The nature of the ground presents a number of difficulties which were responsible for the fact that no haulage plant has been previously located to deliver their material on board the vessels at Frankfort. The only available route seemed problematical, on account of the necessity of a



number of curves and several nearly level stretches of ground. On the one hand a precipitous inclination might have been made use of, but for the fact that the waste dumps were so located as to cut off this means of approach; on the other, property rights prevented the accession of territory which would have been fairly good.

The line selected and illustrated with the map presented on another page contains nine curves of varying degree, and a nearly flat run of 700 or 800 feet, located about the middle of the line, the grade of which is only 1 7 per cent. This is exceedingly light considering the fact that only a moderate grade is available to give the car sufficient momentum to carry it along. However, with the aid of excellently designed cars, rollers and curve pulleys, and a well built track, absolutely no trouble was experienced.

At the head of the line the engine is located, which is equipped with two cylinders, 12"x15", and a drum 48"x48", upon which the rope is coiled. The end of the rope, which is of the best grade of Roebling's crucible cast steel, one inch in diameter, is attached to the car fairly low down, so that the rope is not elevated very much above the rollers, and engages with certainty the curve pulleys after the car passes by. These pulleys are ten inches in diameter and are illustrated in the cut. Between the curves, on the straight portion of the track, wooden rollers five inches in diameter support the rope, except where there is a change of inclination, in which case eight-inch pulleys are employed.

Among the difficulties presented by this line were a number of crossings for teams and pedestrians. At these points the rope passes through conduits open at the top. When the car is at a considerable distance teams can pass over the road without danger. On the approach of the car, one-half minute before its arrival at the crossing, an electrical gong rings automatically giving ample warning. In addition there are other electric signals, operated by push buttons at various points, which communicate with the engineer, so that in case of unlooked for accidents the car may be stopped.

The speed of the rope is from 400 to 800 feet per minute, and about twenty minutes are occupied in a round trip. This gives a capacity to the plant of about 600 tons of rock in ten hours. In addition to the delivery of the stone at the dock, the inclined railway is utilized in hauling supplies up to the quarry. With the 80-horse power boiler and the engine already noted, fifteen tons of material per trip can thus be handled effectively with considerable economy in this regard, the cost of the delivery of supplies being practically nothing, as the cars have to be hoisted up to the quarry anyway, and only a small amount of coal is expended in addition to what would otherwise be consumed.

At first sight it is really remarkable that this inclined railway, with nine curves and several light grades, should work successfully as a single engine

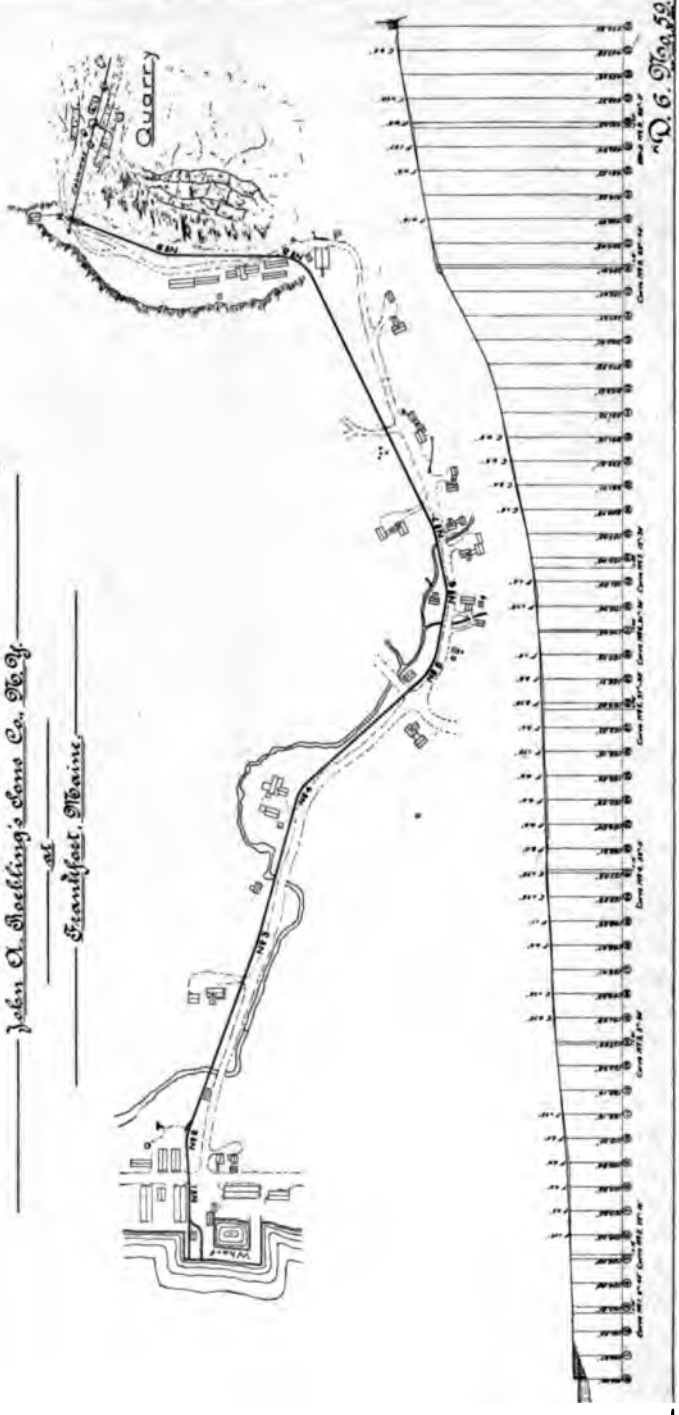
Mount Toledo Incline Railway

designed by

John C. Beckwith & Sons Co. Inc.

at

Grandport, Maine



plant; that is, with but one rope. If the cars and machinery had not been carefully constructed, it would certainly have been a failure, as the 17 per cent. grade in the middle of the line would undoubtedly have stalled the plant.

The greatest care was taken, however, in ballasting and laying the track, which has a gauge of 36", with rails weighing thirty pounds to the yard. All rollers and curve pulleys are well mounted and lubricated and the cars are equipped with double trucks over which are mounted platforms 15 feet long by 6 feet wide. The wheels are of the usual type, with 4-inch axles. All unnecessary friction is eliminated and unavoidable resistances reduced to a minimum. It is confidently expected that this plant has paved the way for many others which engineers have been diffident about installing, but which are really practicable, providing good workmanship is rigidly demanded. This, coupled with a good design, really guarantees success to plants in which many difficulties have to be overcome.

CABLE SYSTEM VS. DERRICKS FOR QUARRIES.

WHILE from time to time there are illustrations in *STONE* of the cable system, comparisons as to the advantages over the derrick system have not been gone into in detail. One cable stretched over a quarry, say only a distance of 400 feet, and 400 feet additional over yard room, making 800 feet between towers, controlling a space 800 feet by 60 feet: This would require at least eight ordinary derricks to cover the same work and eight double drum engines, eight engineers and at least three men for each derrick, tugging and hauling booms around, say a force of twenty-four derrick men. Then they will not accomplish any more work than one twelve or fifteen ton capacity cable plant. For the cable plant only one engineer is required and four or five men to attend to the chaining and dogging of stone. There is no forced work, but a clean lift and rapid travel to any part of yard. All refuse is put in large skips, taken up and carried to dump pile at one handling; no guys in the way or to be made taut every few days; no jerking and breaking down masts or booms, only the towers to be kept painted at regular intervals.

The first cost of a cable plant is not any more than derricks and engines to do the same amount of work, with a saving of more than half in the expense running the cable system, and yet it is very strange that quarry owners will keep on in the old rut.

J. B. Gordon.

✓ PRACTICAL STONE-CUTTING.—VIII.

EXPLANATION OF THE CONSTRUCTION OF A CARD-BOARD REPRESENTATION OF A SOLID, SHOWING THE ACTUAL POSITION OF THE BED AND JOINT SURFACES TOGETHER WITH THE SECTIONS, OF A PIECE OF COPING THE PLAN OF WHICH IS LESS THAN A QUARTER CIRCLE, THE FULL INCLINATION OF THE SECTION PLANE PLACED OVER ONE TANGENT; THE OTHER REMAINING LEVEL.



HIS problem is very similar to that shown in Plate 6, and is one very frequently met with in practice by the stone-cutter. Here, as at last example, the coping starts from a level wall, and in going around the curved plan rises a vertical height, determined at the elevation, or at the development of the center falling line. At the plan Fig. 1, O represents the center with which the plan curves may be drawn. The length of the center curve, A—Q—C, is equal to one-twelfth part of a complete circle; a quadrant being divided into three equal parts. Having with any convenient radius drawn the plan curves, and the joint lines O—A, O—C, produced, square with them draw the tangents A—B, B—C, and produce them. At this example, A—B represents the directing level ordinate, and as previously explained, all plan ordinates are drawn parallel with it. Understanding this, through any points on the plan curves, including A and C, produce the ordinates as shown in N—F, M—m, etc. Then set off L—9 equal to the vertical rise of the coping, and joining A with 9 the full inclination of the section plane may be projected. Now parallel with A—9 draw P—Q indefinitely.

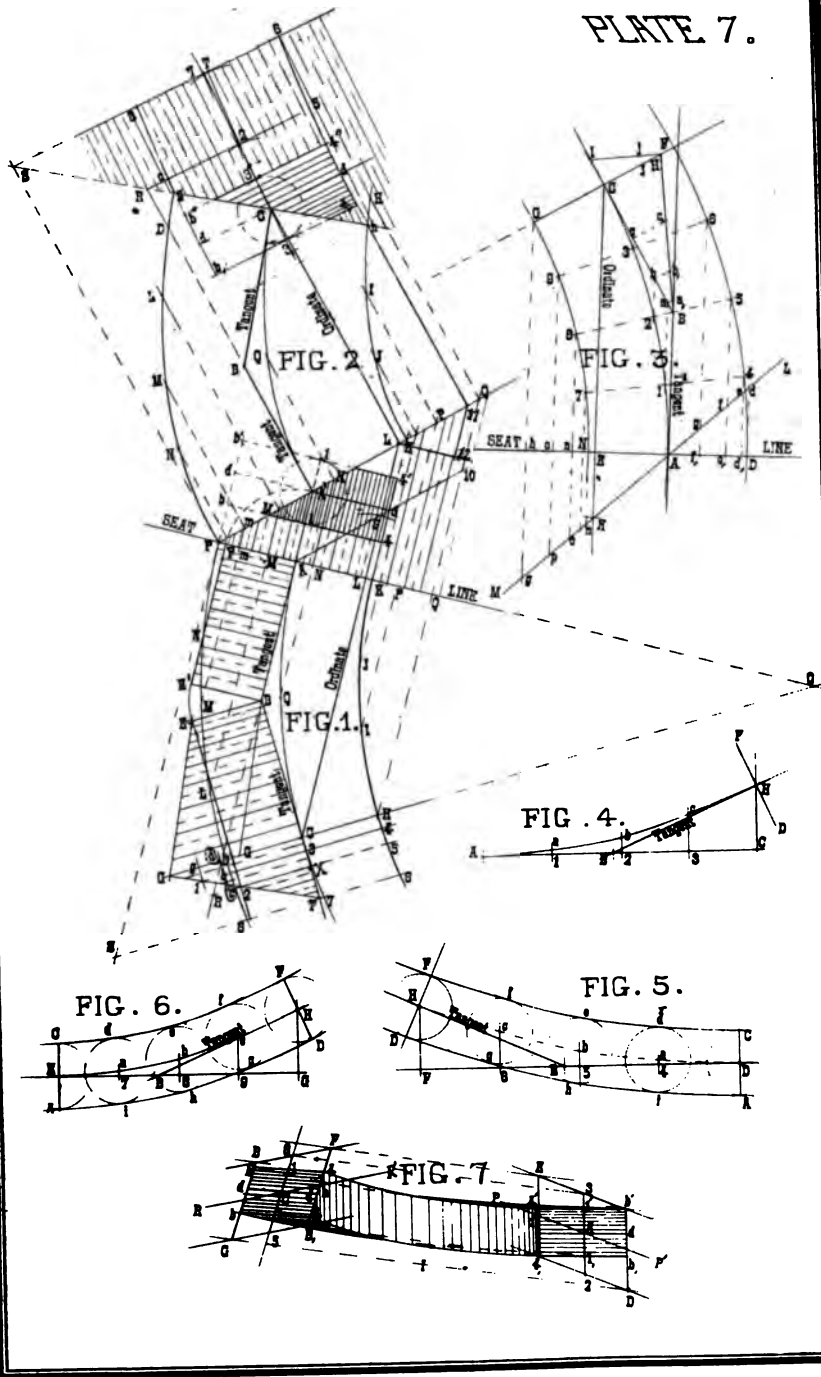
It was previously observed that the seat line, or trace of the Auxiliary Vertical Plane, which may be intersected with the full inclination of the section plane, is a line at right angles with the level ordinate. This rule obtains at all examples. Notice here the joint line O—P becomes the seat line; and the vertical plane represented in Q—P—Q is made to answer a double purpose. Firstly, that of representing the plumb joint surface over A, and secondly that of containing in P—Q the full inclination of the section plane. The point A is raised a vertical height A—A', in order to enable us to show over the plan, with the bed mould projected thereon.

To develop the Elliptical Curves of the Bed Mould: Square with P—

Q draw F—N, m—M, etc., the ordinates of the section plane; make the length of these equal to that of the corresponding ordinates of the plan; the points are obtained in N—M—L, etc., through which to trace the curves. Then joining A—B, B—C, the tangents of the section plane may be obtained. Now through C square with B—C, draw the joint line h—S. We may state: The joint lines of the bed moulds are really the lines in which the joint planes are intersected with the central plane of the bed mould.

Now to draw the representation of the tangent planes which form two sides of the model. First: Square with the tangents of the plan draw B—E', B—E, and C—G; then set off A—F, B—E, B—E', and C—D, each equal to A—A' of the joint surface; join F—E' and E—D; then set off D—G equal to L—9 the rise of coping, and join G with E, this gives the inclination of the coping over the tangent plane. Then square with E—G draw G—T, and the representation of the tangent planes which form two sides of the model may be obtained. Now to obtain a representation of the inclined joint surface, and develop the right section over point C of plan: To do this we have first to ascertain the line in which the tangent plane over B—C of plan intersects the joint surface. This may be found as follows: At Fig. 1 produce the level tangent indefinitely. Then parallel with the joint line O—C through 2, produce R—2—X—5. Now at Fig. 2, with C as center, and G—2, Fig. 1, as radius, describe an arc in 2. Then with R—X, of Fig. 1 as radius, and R of Fig. 2 as center, cut the arc in 2. Joining C with the intersection at 2, the position of the intersection of the tangent plane with the surface of the joint may be found. This is of course a plumb line when in its proper position at the model. If drawing is correct, a line joining 2 with R will be found at right angles with C—2, and gives the position of a level line at the joint surface. Now let us explain the geometrical principle upon which this construction is founded. Notice the ordinates of the section plane through A', and C, intersect the inclined line P—Q, in A'—L, drawing through A', a parallel A'—d, with the base line P—Q; it is shown that the point C, is situated at a vertical height L—d, above point A'. Setting off D—G, of Fig. 1, equal to this height, then drawing the parallel D—2, and producing the level ordinate A—B to R, and drawing the parallel 5—X—2—R through 2 we obtain in R, the horizontal trace of the point R of Fig. 2. Then setting off C—2 and R—2, of Fig. 2, respectively equal to G—2, and R—X, of Fig. 1, it follows that we obtain in the projection 2, a point through which a vertical plane over B—T of the plan passes. This will, of course, be clearly seen at the model, but we have thought it best to explain above the principles of construction employed, in order to show that it is not necessary in practice to develop the whole of the joint surface in order to obtain the joint section. In prac-

PLATE 7.



tice all that is really necessary, will be to find the position of a level line through the intersecting point C, of the section plane, with that of the joint surface. This may readily be found as follows: Parallel with the ordinate C—L, Fig. 2, through h draw h—11; then parallel with the base line P—Q, draw L—12. Set off G—d, of Fig. 1, equal with 11—12; then draw the parallel d—c. Now with G—c as radius and h of Fig. 2, as center describe an arc in d. A line drawn through C tangent with the arc at d, will give the position of a level line at the joint surface through C. Now make C—T Fig. 2, equal to C—T of Fig. 1; and parallel with R—2 draw 6—T—S, and the line in which the joint surface meets the ground plane may be determined. To draw section: Set off G—1 Fig. 1; and C—3 of Fig. 2, equal to the half thickness of the coping; then parallel with O—G draw 1—b—3—4, of Fig. 1, and b—3—4 Fig. 2, parallel with C—d; now make b—3—4, d—C—d, etc., of Fig. 2, equal to the corresponding lengths of Fig. 1, and through them trace the elliptical curves of the section of the joint plane. This will complete the construction of the model. Now take a sharp knife and commencing say at point P of Fig. 2, cut through the outline of the drawing around to K. Then at Fig. 1, commencing at A, follow the outline of tangent planes to T. Then at the lines T—B, B—A, and A—Q of Fig. 1, and P—K and h—g of Fig. 2, cut about half through the board. Now turn up the sides of the model, of course having all lines on the exterior. Then fold over the section planes into their inclined positions, at which they may be secured in any manner which suggests itself to the student. In the manner explained at preceding model, cut two joint sections and secure them in their positions at the joint surfaces, then the manner in which the surfaces twist will be clearly seen. If the student will now cut a copy of the bed mould, and place it on the joint sections above the section plane, so as to have the tangents to fall over the tangents of the model, and the joint line P—L placed vertically over the lower joint surface, it will be noticed, that in order to have the mould parallel with the section plane of model, portions equal to these shown in b—4—E, and b—B—4—F of Fig. 7, have to be added to the joint sections. Also notice the mould projects a distance represented in C—3, beyond the point C of the model. P—P' and R—R' of Fig. 7 represent the central plane of the rough stone on which the bed mould is developed.

In Fig. 3 is shown the manner in which the plan curves, etc., would be divided in practice, in order to find the direction at which to develop the bed mould. First: The rise of the coping is set off at E—K, and the inclined line M—L corresponding to P—Q of Fig. 2, drawn through K—A. Obtaining the points d—e—f, etc., at which the plan ordinates meet the line, the bed mould and joint sections may be developed as explained above for the like operations at Figs. 1—2.

In Figs. 5—6 are shown the developed face moulds. These, as before

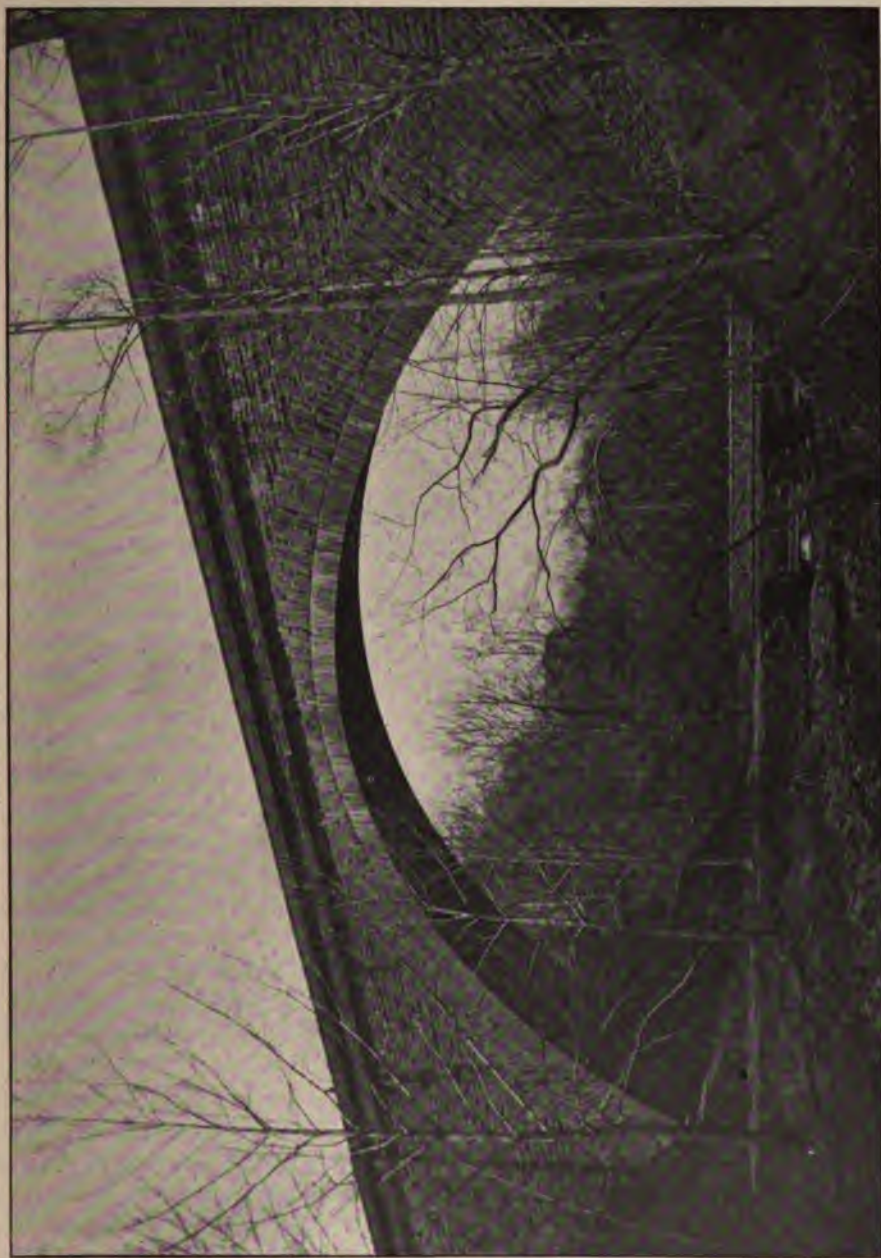
stated, are obtained from directions given by the developed center falling line. In Fig. 3, divide the center curve into any number of parts as shown in A—1—2, etc., through these points produce radials as 4—1—7, etc. Then at Figs. 4, 5, 6, set off A—1—2, etc., respectively equal to the length of the corresponding points of Fig. 3. Now at Fig. 3 parallel with the level tangent A—B, through 1—2—3, etc., produce lines meeting B—C as shown in a—b—c; then square up a—a, b—b, etc. Now at Figs. 4, 5, 3, square up 1—a, 2—b, etc., equal to a—a, b—b, etc., of Fig. 3; through the points obtained trace curves, which will give the center falling lines respectively, over the curves of plan. Then with the half thickness of the coping as radius, and the points D—a—b, etc., of Figs. 5, 6 as the centers, describe arcs as shown. Then tangent with these as shown in C—d—e, etc., and A—1—h, etc., trace curves which give the direction at which to form the upper and lower twisted surfaces of the coping; then set off C—D, F—B, and G—B, equal to C—B of Fig. 3; then join H with B, and square with these draw D—F, and the inclination of the inclined joint surface over C of the plan may be obtained. A—C drawn square with E—G and D—F gives the joint lines as required to form the lower joint surface. *Chas. H. Fox.*

THE CABIN JOHN ARCH.

THE largest stone arch ever built was the one constructed over the river Adda at Trezzo, by order of the Duke of Milan, about the year 1380. It had a span of 251 feet at low water, but it was destroyed in 1427, and now only about 24 feet of the arch ring, near each haunch, remains.

The largest one in existence at the present time, is the Cabin John bridge and aqueduct over Rock Creek, at Washington, D. C. It was designed by Gen. M. C. Meigs, and has a span of 220 feet, a rise of 57 feet, while the roadway of 20 feet width is 101 feet above the stream. The arch ring is of granite, six feet deep at the crown and four feet at the center; the spandrels are of sandstone, laid partially with radial joints. The splendid architectural effect is due to the proportions and to the relief afforded by the projecting courses at the roadway, which gives a cornice-like effect in entire harmony with the whole design. This can best be expressed by quoting from what Fergusson has to say in his "History of Architecture," regarding the efforts of the engineer at architectural effects.

"If this is all that can be done with bridges, (their decoration with inappropriate details) it is far better that they should be left, like most of those recently built, to tell their own tale without any ornament whatever. A long series of tall arches is so beautiful an object in itself that it is difficult to injure it; but occasionally a slight moulding at the impost, a bold accentuation of the arch, and bold marking of the roadway render those beautiful which otherwise may only be useful in appearance." *"F."*



THE CABIN JOHN BRIDGE AND AQUEDUCT, NEAR WASHINGTON, D. C.

SOME FAMOUS SINGLE STONES.



PERHAPS in the whole range of historical stones, no one has so great a reputation, or been seen by so many people as the celebrated "Tawaf," or "black stone" now in the "Kaaba" of the "Holy City of Mecca." Like the famous "Stone of Destiny," this, according to Arabian tradition, had a divine origin, for it is recorded that when Ishmael, his mother, and Abraham were employed founding the Holy City and "re-building" the "Kaaba," which had first been erected by Seth, the son of Adam, and destroyed by the deluge, the angel Gabriel brought this stone and gave it to Abraham and Ishmael as a token of God's pleasure that they had undertaken so good and acceptable work as the rebuilding of a "Holy House." It was received with proper reverence by the twain, and at the completion of the work, was inserted in a corner of the exterior wall where it remains to the present day. When first received it was a single jacinth of dazzling whiteness, but owing to the wickedness of humanity generally it has mourned and shed so many tears and been so often profaned by the touch and kisses of the unrighteous that it has gradually grown dark, until now it is black as jet, and not unlike it in general appearance. It is said the "stone" was one of the precious ones of Paradise, which fell to the earth with Adam, and was afterwards lost in the slime of the deluge, until retrieved by the angel Gabriel. It is also stated that Abraham used the stone as a scaffold while assisting to build the "Kaaba," and that it rose and fell of its own accord to meet the requirements of the builder, and remained in any position he wished it, and as an evidence of this, the print of the patriarch's foot is clearly to be seen on it by all true believers.

Another tradition regarding the stone is, that it was originally the guardian angel appointed to watch over Adam in Paradise, but changed into stone and ejected thence with him at his fall, as a punishment for not having been more vigilant.

That the stone has been known for several thousand years is quite certain for it was sacred to the Arabs long before Mohammed, and the Kaaba is known to have been used as a place of idolatrous worship from time immemorial, and was probably dedicated to Zohal or Saturn. The name of the stone as known to Moslems is "The Right Hand of God on Earth," and serves as a kibleh, or indicator, to show the direction toward which all the faithful must turn in their prayers. All Moslems are expected to visit

Mecca either in person or by proxy during their life-time, and are expected to either kiss this famous stone, or touch it with their left hand, and then kissing the hand that has been so honored.

One of the most famous stones in the world is the "Mexican Calendar Stone." This stone, it appears, was buried by the priests who accompanied Cortez to the ill-fated City of Mexico, in order to prevent the native races from giving it that veneration which had been paid it for many centuries. The stone was unearthed in 1790, and was placed in the base of one of the towers of the cathedral, where it still remains. The stone is 11 feet 9 inches in diameter, and originally weighed twenty-four tons. There are a number of conflicting opinions regarding the purpose of this stone. Some scholars maintain that it was used for sacrificial purposes, others, that it was simply a market record stone, intended merely to point out the days when certain lines of produce would be brought to market, showing, it is stated, the "fish-day," the "fruit-day," the "cotton-day," etc., etc., but the majority argue that it was purely and absolutely an astronomical stone, and was in its nature a perpetual almanac, superior to anything that had gone before, and equal to anything now known, so far as the exactness of the year and its divisions are concerned.

The stone, so far as can be traced, was made in the year 262 B. C., at the instigation of a number of chief astrologers of Anhauc, who had assembled in convention to make such changes as in their wisdom might be necessary to correct the calendar, which it appears had been in existence long before, introduced, it is said by an ancient astrologer named Cipac, but, which, like the Julian calendar, was defective. The result of the labors of this convention was the almost perfect calendar as exhibited on this truly wonderful stone. We do not know in what city of Old Mexico this convention assembled, but we know that the ancient Mexicans or Toltecs began using their corrected calendar 483 years before the ultimate adoption of the Julian calendar at Rome. When the Spaniards, who used the Julian calendars, landed at Vera Cruz in 1520, they were ten days behind the reckoning of the barbarous Aztecs whose method of reckoning at that date was even superior to ours of the present day.

The true astronomical or solar year has been calculated to consist of 365 days, 6 hours, 48 minutes, 49.62 seconds. The Gregorian rule by which all civilized countries, excepting Russia, are now governed, omitting three leap-years in every 400 years, gives to a civil year an average duration of 365 days, 5 hours, 49 minutes and 12 seconds. This exceeds the true solar year by 22.38 seconds, and amounts to the difference of one day in every 3,866 years. But in the Mexican calendar, more than 5,000 years would have to lapse before there would be a loss of an entire day. It will thus be

seen that our Gregorian calendar is not as near perfection as the old Mexican, and then, the latter mode of reckoning was so very simple.

The peculiar stone of which this famous calendar is made, is a very hard, blackish basalt, and bears evidence of having been wrought by hard metal tools, such as were not in existence in Mexico when Cortez invaded that country. The known age of the stone is over 2,000 years. The carving and inscriptions are fairly well executed, and are noted for their uniform regularity.

Fred T. Hodgson.

COLORS USED IN DRAWINGS.

A CORRESPONDENT of the National Builder gives the following colors used to designate materials in architectural drawings :

Materials.

Brass.
Brickwork (in section).
Brickwork (in elevation).
Cement.
Concrete.
Copper.
Glass.
Iron.(wrought).
Iron (cast).
Lead.
Leather.
Plaster.
Slate.
Steel.
Stone.
Tiles.
Wood.

Colors to Represent Them.

Gamboge.
Crimson lake.
Crimson lake, mixed with burnt sienna.
Sepia.
Sepia, mottled with burnt umber.
Crimson lake, mixed with gamboge.
Cobalt (mottled).
Prussian blue.
Payne's gray.
Indigo.
Vandyke brown.
Sepia.
Indigo, mixed with crimson lake.
Crimson lake, mixed with Prussian blue.
Burnt umber.
Indian red.
Burnt sienna.



Slate and Shale.*

Slate, like building stone and limestone is quarried from the earth's crust and is found in the strata close above the metamorphic rocks, near the beginning of what is called the primary, or paleozoic period. As compared with the coal formations it is very, very old. There are different substances called slate that are not slate in the scientific use of that word. In general all stone formations are called slates that split up into thin layers. But the true slate is a special material which is formed by special processes of nature. The difference between slate and shale, for instance, is not one of ingredients, but of the process by which the ingredients are put together. All of the sedimentary rocks are formed by a deposit in the bottom of the ocean. At one period the floods have brought down a certain kind of material in greater profusion than at others, and this is deposited in thin layers, and as it hardens there will be seams in it and the stratifications will be differently colored, the color depending upon the deposit at any particular time.

A bed of shale like a bed of coal has lines of cleavage in it, and if it is examined under a microscope it will be found that the sedimentary particles, like twigs and leaves in the coal veins, lie with their longest dimensions in line with the plane of cleavage. Shale in color looks like slate and an analysis of the material of which it is formed shows that shale and slate are both made from the same. There is, however, a structural difference between the two which is very peculiar and very interesting. The slate is ordinarily a denser material and the lines of cleavage are often at right angles with those that we find in ordinary shale. A slab of shale will be of a uniform color on any one line of cleavage. The color may change at the next line and generally does to a slight extent. It is easy to see them if we could change the lines of cleavage in the shale, so as to run at right angles with their present lines. The face of a slab would show bands of different colors

or shadings, such as we often see in slate. If we take a piece of clay that has been thoroughly mixed and subject it to a very great pressure and then examine the piece that has been submitted to pressure under a microscope and compare it with a piece of the clay after it has been thoroughly mixed, but has not been submitted to pressure, you will find that the two are very different in structure. The pressed clay will show that the particles of which it is made up have all turned, so that their longest dimensions are in a line at right angles with the direction of pressure. Here is an interesting fact that we must remember. And it is in this that we find the reason for the structural difference between shale and slate. The lines of cleavage in shale are not formed necessarily by pressure, but because in the disposition of the material of which it was formed, the particles naturally laid themselves down so that their longest dimensions were on a horizontal line.

Ages after, when other rock and other formations had been laid down on top of the bed of deposited mud, the upheavals of the earth have so changed the lines of pressure upon this material, and the pressure is so great, that a rearrangement of the particles of which the slate is made up has taken place, so that their longest dimensions now are in a direction that crosses the stratifications as originally laid down.

The effects of this is twofold. First, the material is compressed into a denser form and the lines of cleavage are changed, or to express it in more common language, the grain has been changed, so that when it splits up it runs crosswise of the original layers as the water deposited them, and this produces the different shadings so often seen in different slates.

Let us go back a moment to our experiment with a lump of clay. If we examine the mixture before submitted to pressure we would find that the oblong particles of which it was made up would stand in all directions, hit or miss, and if we should dry this lump of clay it would have no special lines of cleavage. But the moment we have submitted

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it to a certain amount of pressure, we find that lines of cleavage have been established, and that the particles have been rearranged so that their longest dimensions are all in one direction which coincides with the cleavage lines. If we should now take this same piece of clay and subject it to a pressure at right angles to that of the first experiment we would find that the lines of cleavage had also changed, and that the particles had all been rearranged. Apply the principle to the formation of slate, and we can understand how it happens that what we call the grain runs crosswise of the deposits that were made at different times. It is not a chemical, but purely a mechanical difference. Or, to express it differently—the difference is a structural one produced by mechanical causes. The origin of cleavage in slate has been the subject of much speculation and investigation, but like many other problems it was solved through the invention and application of the microscope. Thin layers of slate have been made the same as with limestone and chalk, so thin that the light would readily pass through it so that an examination of the particles could be readily made, showing their arrangement under varied conditions. Science is indebted to the microscope for the solution of very many problems that for ages before had puzzled philosophers.—Elisha Gray, Ph. D., L. L. D., in *Times-Herald*.

Relative Value of Coal and Wood as Fuel.

Strange as it may appear to those who have never lived outside large cities where a big price must be paid for a little wood for kindling purposes, there are still many localities in this and other countries where wood is the cheapest fuel to be had. Gradually, in many of these places, this is being reversed and coal becomes cheaper than wood, but it will be many years before it is universally reversed, if that time should ever come.

As might be expected, the question of whether it would be advisable to change from one kind of fuel to the other is sometimes puzzling, but can generally

be determined from a consideration of the comparative value of the different kinds of wood for steam making. The relative values of coal and different kinds of wood for this purpose is about as follows, the coal being of a fairly good quality.

One cord of hickory or maple wood is equal to 1,800 pounds of coal; one cord of white oak is equal to 1,550 pounds of coal; one cord of beech is equal to 1,300 pounds of coal; one cord of chestnut is equal to 950 pounds of coal. Red or black oak is about equal to beech, and elm and poplar to chestnut.

To make a comparison, say the wood obtainable is beech and oak. One cord of wood is equal to 1,300 pounds of coal. Then $2,000 \div 1,300 = 1.54$; one net ton of coal is equal to $1\frac{1}{2}$ cords of wood. Say coal in the locality is worth \$4 per net ton. Then $4 \div 1.54 = 2.59$. Coal at \$4 per net ton and wood at \$2.59 per cord would be on terms of equality.

Pound for pound one kind of wood is about as valuable as another, $2\frac{1}{4}$ pounds of dry wood being equal to 1 pound of coal.

When wood is used for fuel it should be thoroughly dry. There is a very material loss in burning wet wood. There is also some loss in burning wet coal, but it is only trifling compared with the loss from burning wet wood.—*Tradesman*.

Monuments To—Who Was He?

The number of men whom their associates yet living in almost all localities deem worthy of commemoration in enduring bronze or granite monuments, erected in the most public places, is very much larger than the list of those whom posterity will care about remembering. Most of these local heroes "bore well their part" and well deserve the affectionate remembrance of their city or state. But after all they were but units in a great crowd of patriots who rendered distinguished services to the country at one time or another. Posterity cannot remember them all. Only a few leaders in war, or distinguished benefactors in time of peace, can hope to escape oblivion. And it will be a very safe rule not to erect too prominent or too costly a

monument to any man concerning whom the average well-informed visitor will have to ask ten or twenty years hence: "Who was he?" with perhaps no certainty of a correct reply.

Far to be preferred above these individual memorials are those that, like the proposed soldiers' monument in St. Paul, commemorate the collective achievements of the people's local heroes in some crisis like the Rebellion. In these every one that bore a part in making his era glorious has a share. There is no invidious preference of one over another—a preference which, in the individual monument, often arises solely from the superior activity of one departed hero's friends as compared with that of the friends of others. There is no danger that the question will ever be asked, "Who were they?" by the visitor standing before the soldiers' monument.

Patriotism should not be brought into competition with Mammon in monument building. Senseless display in the erection of their own monuments has become a fad with those rich men who fail to realize how much more honorable and enduring is a memorial which takes the form of a school, a hospital, a library or a college endowment. Great private mausoleums and pillared tombs, costing from \$50,000 to \$500,000, and marking the graves of men of whom nothing whatever can be told some years hence except that they "died rich," are multiplying; and they belittle the public monuments unless they are adorned with "names imperishable." For there are a few—the grand figures of every era—the greatness of whose contributions to the weal of nation or mankind, in making their fame wholly independent of all memorials carved by other hands, marks them as peculiarly the proper subjects for such memorials. In erecting monuments to such, we honor not only individuals but ideals; and their memorials may well occupy the most conspicuous place in town or park—places for which there can be no future rivalry. But let us not fill those sites with sculptured memorials of—"Who was he?"—to be removed perchance by our grandchildren, in making room for some one whose fame has not

"died out."—St. Paul (Minn.) Pioneer Press.

Tennessee Marble.

Geographically considered, the Tennessee marbles can be referred to the Trenton and Nashville series, which are the overlaying beds of the lower Silurian formations. All these formations strike northeast and southwest, and vary from horizontal to dips of high angles. Of the colored marbles there are endless varieties, from the most delicate pink to the rich brown and chocolate, the gray and the dark variegated. This great diversity extends to the texture as well as the color, and the widest possible field is afforded to architects and artists in stone to exercise their taste in the selection and combination of colors. It is only of late that this diversity in these marbles has been known to the trade. The lighter colors, such as gray and the different shades of pink, seem to meet the popular fancy. As shown by chemical and crushing tests, these marbles are practically impervious to moisture and discoloring agencies, and have all the requirements of a first-class building material, a material that will last for generations.

At the present time there are fourteen quarries in operation in Knox and Blount counties, with an average output of 30,000 cubic feet per month. This product is of the different varieties and colors, and is shipped all over the United States, from Maine to California, in the rough block, in sawed slabs, and in the finished state for the interior decoration of buildings. There are four mills located in Knoxville, which finish and ship marble to the trade. There is over \$3,000,000 invested in Tennessee marble. The trade, like all other trades at the present, is not in a satisfactory condition, prices being cut by the different quarries in their anxiety to make sales. What the trade needs is laws to protect it in connection with other manufacturing interests in Tennessee. Then it will be no trouble to induce capital to invest in this industry, as the marble industries of the States are still in their infancy, and are susceptible of development on a scale

of great magnitude.—New York Commercial American.

A Quarry That Produces Natural Dimension Stone.

There is a large granite quarry about fifty miles from St. John's, New Foundland, where granite has been hewn, by some convulsion of nature, into rectangular blocks of different sizes, so conveniently assorted that schooner loads of selected stones have been brought to St. John's and used in some of the public buildings and warehouses with little or no hand dressing by masons. The new postoffice and custom house built after the great fire which practically wiped out all the business part of the town, are partly constructed of these granite stones hewn by nature.

No Allowance Made for the Expansion of Granite.

Another of the many mistakes that have been made in the construction of the state capitol came to light recently. A number of workmen were started early in the day with mallets and chisels cutting off a long section of the stone flooring of the balconies on the east and west sides of the big building. Inquiry revealed the fact that in building the balcony, allowance had not been made for the expansion of the granite blocks, so that the walls rising from the street showed a tendency to bulge outward. It became necessary to cut a slit or slight recess in the stone to permit the wall to retain its normal perpendicularity.—Albany (N. Y.) Press and Knickerbocker.

A Tree Monument.

One of the most noticeable things to any one entering the cemetery grounds at Angelica, Allegany county, New York, is an old marble slab stone on which is the following inscription: "Ira Stephens, who died September 20, 1803, aged 43 years," says the Utica Press. Exactly in the center of the grave is a huge elm tree, which is eighty feet high, and the

trunk is as fine a specimen of an elm tree as can be found. The roots spread all over the grave and nearly tip the marble slab, green and moldy with age, over on its face. The peculiar position of the tree, right in the center of a grave, causes strangers to wonder how it came there.

Those in charge of the last Allegany county history, before offering it to the publishers, decided to trace, if possible, from old residents, the cause of the tree being in so peculiar a place. They found out and published in their history the following information: "The first death in Angelica was Ira Stephens, who, on the authority of Mr. Gibson, a resident of Angelica, was killed in a quarrel over cards at Joseph Wilson's inn, and he was the first one buried in Angelica Cemetery. He was killed by some one unknown, with a huge elm club, which was buried with him. Directly over the grave has grown a large elm tree, which superstitious and credulous people say grew from the club with which he was killed."

The Decay of Natural Materials.

Whoever expects to find a stone that will stand from century to century, defying alike the frigid rains and scorching solar rays without need of reparation, will indeed search for "the philosopher's stone." There is scarcely a substance which, after having been exposed to the action of the atmosphere for a considerable time, does not exhibit proofs of "weathering;" it may even be observed on the most densely compacted siliceous rocks. The fullest extent of this inquiry can only be to elucidate relative duration and comparative labor of appropriation to useful or ornamental purposes.

By examining the various productions of nature we find evident proofs of her industry in all ages; changes have been going on from the remotest antiquity to the present time on every substance that comes within our observation. All the actual combinations of matter have had a former existence in some other state. Nothing exists in nature but what is likely to change its condition and manner of being. No material is so durable as

always to retain its present appearance, for the most solid and compact bodies have not such a degree of impenetrability and so close a union of the parts which compose them as to be exempted from ultimate dissolution.

Even in the great globe which we inhabit nothing is more evident to geologists than a perpetual series of alterations; there can be discovered no vestige of a beginning, no prospect of an end. In some bodies these changes are not so frequent and remarkable as in others, though equally certain at a more distant period. The venerable remains of Egyptian splendor, many of them executed in the hardest granite between 3,000 and 4,000 years since, exhibit large portions of exfoliation and gradual decay, thereby following the primitive, immutable and universal order of causes and effects, namely, that all objects possess the materials of which they are composed only for a limited time, during which some powerful agent effects their decomposition and sets the elementary particles at liberty again to form other equally perfect combinations. Thus by divine and unerring laws order is restored amid apparent confusion.—The Architect.

What Competition Does.

The stone quarry owners of this valley are confronted with some very serious problems, says the Joliet (Ill.) News. Eight or ten years ago the owner of a stone quarry was considered as fortunate as the owner of a Klondike. In an interview with George H. Munroe, of the Western Stone Company, much surprising information was disclosed.

He said: "This trouble with the quarriers is quite an unfortunate matter. The fact is, men are working at Davison's, Keltie's, Krakar's, and several others, at \$1.75 for ten hours, and at Porter's, Joliet Limestone, and the Western, at \$1.50 for ten hours, and that is all that these concerns can possibly afford to pay, owing to competition with cement, Cleveland sandstone, Bedford and other stone. I wish that we could pay \$2 per day. But there are good and sufficient reasons why not more than 15

cents an hour can be paid, and we would welcome an interview with the leaders of the strike and give them every facility for finding out the facts.

"It was but a few years ago when, for instance, Western Stone Company stock sold in the market at 128 (it cost the original owners \$100 per share of \$100) and the stockholders were getting 10 per cent. dividends. To-day the same stock will not sell at more than 35 to 40 cents, and the companies are not earning any dividends. It is a question of competition with cement and other kinds of stone which causes the trouble. First comes the cement problem. The Rock Island and other railroads are largely using cement. They not only put in culverts and bridge piers of cement, but they lay copings for buildings and use it wherever it can possibly be made to stand. It requires very little skilled labor to utilize it. Most of the men who handle sand to mix the mortar get \$1.25 per day.

"The Cleveland sandstone is another factor. Now the specifications for curbing in nearly all the streets of Chicago call for that kind of stone. It comes out of the quarries soft and can be sawed very easily indeed. Bedford stone is called for in the more ornamental parts of buildings. Even this is much easier to work than Joliet limestone. While an inch is being sawed of the latter, two inches can be sawed through Bedford stone.

"The price of stone products has declined in proportion to the increased demand for the products of our three great elements of competition. We can afford to continue running the quarry at \$1.50 per day of ten hours, but if the change is made to eight for the same money, our competitors in cement and other kinds of stone will get the business. We have a large contract with the Pennsylvania Central Railroad Company for furnishing stone for part of the work in track elevation in Chicago. The superintendent informs us that the moment we fail to ship our stone promptly they will put the cement in its place.

"There is another thing I wish to call attention to, and that is the fact that the men who are willing to work are threat-

ened so violently that they are really afraid to continue. Were it not for this fact, there would be no trouble in securing plenty of men."

Wm. C. Townsend.

This pioneer of the granite monument industry, and during all his career as such the most conspicuous man in the business, died at his home in Zanesville,



O., June 8, after a short illness, aged 55 years. His death takes another name from the list of veteran soldiers who came out of the civil war less robust than when they entered it. He had carried with him ever since that terrible experience the baneful effects of the exposure and trial he had passed in the service of his country.

To him more than to any one man contemporary with him, must be accorded credit for the development of the granite monumental industry. From that of retailer he pushed his business with

such energy that his house commanded a wholesale trade in granite and marble monuments greater than any single concern in the country, having branches in New York, with quarries in Scotland and Italy. He gained this distinction and success in the face of opposition that would discourage a less courageous spirit. He was an honest man. He was a firm friend. He made enemies, but these universally respected him for his upright character. Not much more can be said of a manly business man than could be truly said of him — that dead those who waged commercial contest with him, sorrow that he departed life at the zenith time of his success, before he could enjoy the full measure of life's tribute to the industrious and persevering.

Mr. Townsend had so fixed his worldly affairs that they could be carried on uninterruptedly when he was called away. The business will be continued by his partner and heirs. He leaves a wife and one son.

We are indebted to the Monumental News for the engraved portrait herewith.

An Unusual Condition.

John Madison, the stonemason and contractor, who returned from Clear Lake yesterday, tells of unusual but very satisfactory conditions existing in that section, says the Sioux Falls (S. D.) Press. The conditions are unusual because they have not confronted the people there or elsewhere in this region during the past six to eight years, but will be common for the coming six to eight years all over this end of South Dakota. The state of things referred to is the great amount of building improvements in progress and in contemplation there and the great scarcity of skilled workmen. Dozens of different jobs for stone and brick masons

are standing still simply because there are no masons to be obtained. Mr. Madison went there a short time since and found more work than he could do at his own price, but was compelled to return to take charge of a big contract that has just been awarded to him at Le Mars, Iowa. Builders at Clear Lake begged him to remain and complete rock foundations at any price. He says two score of brick and rock masons could secure steady and very remunerative employment at Clear Lake and in that section during the entire season. At the small town of Aruzburg, ten miles from Watertown, a \$12,000 granite church edifice is in course of erection and only one stonemason is employed on the improvement. This state of affairs Mr. Madison regards as remarkable, in view of the number of masons out of employment in the larger towns of the country. Sioux City, he thinks, could turn out a hundred idle stone and brick masons, and he mentioned a few who could be spared from this city.

"We can't blame Eastern people," remarked Mr. Madison, "for regarding South Dakota as an indifferent region when our own citizens here in Sioux Falls are so ignorant of the superior agricultural and commercial character of the Clear Lake district. I had no idea it was the country it is until I arrived there. It is a garden spot and is improving very rapidly. Al Williams, the banker there, who was formerly in business in Sioux Falls, and who is in town to-day, has sold over 15,000 acres of land in that section the present spring. Building improvements are going up everywhere as fast as carpenters and masons can be secured to do the work."

The Council Bluffs Convention.

The first annual convention of the marble and granite dealers of the middle west met at Council Bluffs, Iowa, July 12th, with about fifty delegates present. In view of the fact that many more were expected there was but little done beyond the selection of temporary officers. J. M. Graham of Des Moines, was chosen as president pro tem., and George J. Gruber,

of Muscatine, was made secretary pro tem. In the afternoon the convention adjourned and the delegates went to the Trans-Mississippi Exposition in a body.

COUNCIL BLUFFS, Ia., July 13.—There was a largely increased attendance on to-day's deliberations of the marble and granite workers, and the parlors of the Ogden Hotel were vacated for a near-by hall. A national organization was effected, and the following officers were elected:

President—J. M. Graham, Des Moines, Iowa.

Vice president—C. Niedhart, Beatrice, Nebraska.

Secretary and treasurer—J. M. Kildow, York, Nebraska.

Resolutions were adopted denouncing scalpers and announcing the purpose of the organization to be for the protection of the trade of legitimate dealers, and declaring all who sold non-members of the association scalpers. The balance of the day was devoted to speech-making.

Georgia Granite and Slate.

Georgia granite is well known in many parts of the country, for in recent years it has been shipped to almost all parts of the United States, contracts being secured for this material, notwithstanding the enormous freights, which are so much against the enterprise. The coping around Riverside park, in New York City, and the Carnegie public library, at Pittsburg, Pa., are built of Stone Mountain granite. In addition to this, this celebrated locality has furnished large quantities of paving blocks for different cities in the United States. With Macon as its headquarters, the Georgia-Quincy Granite Company has for some years been actively engaged quarrying the excellent building granite at Sparta, Hancock county, this material being used almost altogether for the superstructure of buildings and for paving blocks. They also have an extensive quarry in the contorted gneiss at Odessa, in Meriwether county. Quite a number of quarries have been opened and operated near Lexington, Oglethorpe county, and near Elberton, Elbert county, on the

beautiful, fine-grained, blue granite of these counties, nearly all of the material being used for monumental purposes.

The Venable & Collins Granite company, of Atlanta, is now actively engaged in quarrying and manufacturing a handsome blue granite from their quarry in Elbert county. Recently two quarries have been started near Eatonton, in Putnam county, in a stone very similar to the blue granite just mentioned. There are quite a number of extensive deposits of granite and gneiss of the best quality

for both monumental and building purposes in different parts of the state which as yet have not been opened.

Beautiful slate of the best grade occurs at Rockmart, in Polk county, where it has been quarried by the Georgia Slate company, and by other companies for the past few years. The product for 1895 was 2,500 squares, but at the close of that year the producers were better prepared than ever before to fill orders promptly, and a steady improvement was looked for.—Salmagundi.

OUR FOREIGN TRADE IN STONES, ETC.

From the monthly summary of finance and commerce of the United States, corrected to June 27, 1898, we compile the following:

ARTICLES.	MAY.				ELEVEN MONTHS ENDING MAY—			
	1897		1898		1897		1898	
	Quan.	Values.	Quan.	Values.	Quan.	Values.	Quan.	Values.
<i>Imports—</i>		<i>Dollars</i>		<i>Dollars</i>		<i>Dollars</i>		<i>Dollars.</i>
Cement (lbs.):								
Imp. from—								
United Kingdom.....	13,682,492	42,914	2,937,400	10,318	174,378,631	565,057	111,410,898	372,088
Belgium.....	28,807,448	73,875	23,327,164	67,606	233,983,991	678,768	915,420,581	646,395
France.....	2,386,112	7,864	148,800	600	11,814,500	34,829	12,465,016	26,878
Germany.....	61,183,780	195,561	46,717,896	157,958	409,663,916	1,389,233	875,888,883	1,398,085
Other Europe.....	3,776,508	12,825	2,738,302	8,911	13,302,704	48,512	20,180,483	63,344
British North America	171,500	894	473,125	2,390	2,396,800	9,394	1,964,874	9,637
Other countries.....			5,200	67	808,011	3,872	5,300	87
Total.....	107,416,836	349,853	76,877,917	247,616	846,272,463	2,677,404	737,336,939	2,390,922
Marble, and mfrs. of		111,586		71,828		806,068		630,753
Stones, & manufactures								
of, including slate...		81,196		22,044		790,439		220,879
Total.....		192,781		93,872		1,096,507		850,633
<i>Exports—</i>								
Marble and stone, and								
manufactures of:								
Unmanufactured.....		4,977		4,827		56,989		86,356
Manufactures of—								
Roofing slate.....		124,449		187,195		701,633		1,238,046
All other.....		32,923		35,836		506,435		376,811
Total.....		162,349		177,858		1,265,056		1,702,640
Cement..... bbls	3,050	5,855	6,061	11,682	30,907	67,155	46,530	81,331
<i>Exports foreign mfrs.</i>								
Cement, Rom., Portland								
etc..... lbs	86,697	401	40,938	195	2,563,398	9, 96	3,904,243	14,879
Marble, & mfrs. of.....		3		13		5,620		2,454
Stones, & mfrs. of includ-								
ing slate.....		4,800		804		14,597		2,419
Total.....		4,863		817		20,523		4,873

Merchandise Remaining in Warehouse on May 31, 1897, and 1898 Respectively.

ARTICLES.	April			
	1897		1898.	
	Quantities.	Values.	Quantities.	Values.
Cement, Roman, Portland, etc..... lbs...	8,510,574	\$ 22,922	3,775,585	\$ 10,417
Marble and stone, and manufactures of:				
Marble, and manufactures of.....		19,406		52,728
Stone, and manufactures of, including slate.....		1,441		9,840
Total.....		21,347		62,568

Imports into the United States from France 1871-1897.

ARTICLES.	POUNDS.					DOLLARS.				
	1893	1894	1895	1896	1897	1893	1894	1895	1896	1897
Cement.....	4,434,925	4,835,103	6,479,970	10,685,697	12,849,771	14,608	16, 28	21, 206	33, 124	37, 467
Marble and stone, and mfrs. of						1,4674	97, 174	76, 556	63, 086	97, 196

EXPORTS DECLARED

For the United States. Returns from Consular districts for quarter ended December 31, 1897:

BELGIUM.			
<i>Antwerp</i> —		<i>Florence</i> —	
Cement.....	\$ 4,921.50	Alabaster statuary.....	5,931.00
Stone.....	6,337.55	Marble statuary.....	11,139.00
<i>Brussels</i> —		<i>Genoa</i> —	
Cement.....	153,355.03	Stone:	
Marble.....	1,809.88	Pumice.....	300.35
Stones, ground flint.....	214.82	Whet.....	669.05
<i>Ghent</i> —		<i>Leghorn</i> —	
Cement.....	512.97	Marble:	
DENMARK.		Blocks.....	3,156.62
<i>Copenhagen</i> —		Statuary.....	155.63
Cement.....	2,363.48	Slabs.....	21.23
DOMINION OF CANADA.		Pumice stone.....	5,362.13
<i>St. John</i> —		<i>Messina</i> —	
Cement.....	325.00	Pumice stone.....	4,049.00
Granite.....	656.00	<i>Rome</i> —	
<i>Port Joggins</i> —		Statuary (marble) and pedestals ..	1,980.41
Grindstone.....	4,025.00	<i>Venice</i> —	
Whetstones.....	112.00	Marble statuary and work.	1,550.46
<i>Clifton</i> —		Stone:	
Stones.....	137.10	Rough.....	442.20
<i>Sault Ste. Marie</i> —		Carvings.....	564.40
Rock (broken trap).....	3,825.00	MEXICO.	
FRANCE.		<i>Cindad Juarez</i> —	
<i>Lille</i> —		Onyx.....	14.00
Sculptured stone.....	322.00	<i>Veracruz</i> —	
<i>Marseilles</i> —		Onyx.....	4,413.61
Cement.....	1,850.85	SPAIN.	
Marbles for mosaics.....	1,017.50	<i>Barcelona</i> —	
<i>Paris</i> —		Cement.....	829.38
Millstone and marble.....	11,390.00	SWEDEN AND NORWAY.	
GERMANY.		<i>Christiana</i> —	
<i>Bamberg</i> —		Marble, in blocks.....	1,217.25
Grindstone.....	912.51	<i>Helsingborg</i> —	
<i>Bremen</i> —		Cement.....	1,397.71
Cement.....	9,317.22	<i>Stockholm</i> —	
<i>Brunswick</i> —		Cement.....	11,514.73
Cement.....	7,505.00	TURKEY IN ASIA.	
<i>Frankfort</i> —		<i>Symrna</i> —	
Cement, Portland and other	1,309 00	Emery stone.....	13,712.38
<i>Hamburg</i> —		UNITED KINGDOM.	
Cement, Portland.....	169,713.56	<i>Aberdeen</i> —	
<i>Hanover</i> —		Granite, polished.....	32,597.84
Cement, Portland.....	32,353.45	<i>Carlisle</i> —	
<i>Mainz</i> —		Granite, monument.....	2,168.17
Cement.....	31,732.85	<i>Dublin</i> —	
<i>Mannheim</i> —		Marble.....	1,900.44
Cement, portland.....	1,234.32	<i>Edinburgh</i> —	
Pumice stone.....	227.59	Stone.....	208.71
<i>Nuremberg</i> —		Stone wheels (grindstone).	489.79
Lithographic stones.....	10,115.45	<i>Glasgow</i> —	
<i>Stettin</i> —		Stone and stoneware.....	1,092.75
Cement.....	50,289.44	<i>Hull</i> —	
<i>Stuttgart</i> —		Cliff stone.....	2,200.92
Pumice stone.....	1,725.35	<i>Liverpool</i> —	
ITALY.		Cement.....	364.98
<i>Carrara</i> —		<i>London</i> —	
Marble:		Cement.....	53,760.00
Blocks.....	\$88,967.33	Stone, marble, granite, etc.,	6,847.12
Slabs.....	14,540.96	<i>Newcastle-on-Tyne</i> —	
Statuary.....	10,428.36	Grindstone.....	6,190.19
Worked.....	1,753.50	<i>Plymouth</i> —	
Cubes.....	1,904.90	Stone.....	1,013.93
Tiles.....	563.75	<i>Sheffield</i> —	
Total.....	118,158.80	Grindstones.....	242.68
		<i>Troon</i> —	
		Hone stone.....	749.10

South African Stone Trade.

Cape Colony, during 1897, consumed 69,920,051 pounds of cement, and stone and slate of all kinds to a value of \$95,935. In Cape Colony and Natal there were in 1897 in operation, 147 stone quarries, with only 78 employes, and 6 stone and marble works with 256 employes.

Marble Decoration of Buildings.

There are two distinct methods of decorating the surface of buildings with marble, of both of which there are abundant examples in Italy. The first was that practiced in Venice, and consisted of veneering brick and stone walls with thin slabs of marble. In the other, practiced at Bergamo, Cremona, and Como, the marble formed a portion of the wall itself. "These two modes led," said Mr. G. E. Street, "to two entirely different styles and mode of architecture. It might almost be said that one mode was devised to the concealment and the other with a view to the expansion of the real mode of construction."

This criticism is in need however of much modification. It is needless to state that effects of great beauty, combined with architectural truth, have been obtained by the use of solid marble blocks. In old Italian examples the colors of the marble were alternated in horizontal bands, sometimes in equal widths, and in others with narrow courses of white marble between broader ones of dark color. Sometimes straight lintels were formed, differing in color and ingeniously keyed together. But this mode of marble decoration is too costly to be adopted to any considerable extent in this country, and we are therefore compelled, in the majority of cases, to resort to the Venetian method, which adapts itself very conveniently to the purposes of internal decoration, and enables us to do full justice to the materials employed.

The beauty of colored marble can only be properly appreciated when it is seen in large masses. When it is cut into the average sizes of ordinary building stones and bonded into a wall, we lose the

majesty of effect resulting from the use of a single polished slab of large dimensions such as we can only have in veneered work, and in the right use of marble veneer there need be no attempt to deceive the eye. With the use of slabs too large to be mistaken for solid blocks, and with the long vertical joints necessitated, when paneling with variously colored marbles is employed, we follow a treatment strictly non-constructural. When we have a marble with any decidedly marked pattern in it we can saw it into thin slices, and by reversing these and placing them in juxtaposition, we can obtain very beautiful effects in a perfectly legitimate manner. A panel of this kind tells its own tale at once. The sections composing it cannot consist of entirely separate blocks, and they can be put together without any attempt to break joints.

Mouldings are generally necessary to emphasize the lines of panel decoration. A moulding may be run upon the edge of a marble stile, but if the marble be of any decided pattern the veins or other marks cutting across the lines of the mouldings will greatly detract from its effect. What is needed in the majority of cases is a separate boundary of color between the two surfaces. The stile being darker than the panel, the moulding should be in a darker material than either, and with panels in strongly colored marble, black mouldings become necessary. In paneling we have a form of decoration eminently suitable for execution in marble, because it affords such excellent opportunities for displaying the beauty of the material. One way of exhibiting the beauty of marble in the form of panels consists in employing very thin slabs for windows in place of glass. Oriental alabaster, or Algerian and Mexican onyx are very suitable for this purpose; but if exposed to the weather it is prudent to protect the outside surfaces with glass.

Circular work in marble paneling, or casings, is usually cut out of the solid to avoid numerous joints, the appearance of which is considered unsightly. The advantage of a large unbroken surface is thus obtained, often at considerable ex-

pense. The Byzantine architects seem to have studied economy more closely in this respect. In the mosque of St. Sophia, Constantinople, for example, portions circular upon plan are veneered with marble cut in narrow strips, each presenting a flat surface, so that the whole is polygonal instead of curved. In some modern designs for boxed marble trusses inclosing cantilevers of iron the sides are in single slabs, while the soffit being considerably curved in form is made up of a number of small pieces all tongued together, and having a series of reeds, or other small mouldings, running transversely, with deep quirks between them in which the joints are concealed.

Flights of steps can frequently be constructed to advantage in boxed marble. The treads may be $1\frac{1}{4}$ inches or more in thickness, with moulded nosings, slabs 1 inch thick being used as risers. The steps are usually supported upon raking beams of iron, the outer strings and soffits being formed with marble slabs and having suitable mouldings. In constructing such flights great care is often taken to match the steps and risers so that the former may appear to be solid, but it would frequently be better if the risers were made of a different marble from the treads, a more highly colored material being used for the former than the latter. It is better not to polish the treads, because by this means they are rendered so slippery as to be dangerous, but the full beauty of the risers may be brought out by having these of a highly polished surface.—The Stonemason.

Manila Hemp

Is the product of a species of banana (*Musa textilis*), and is cultivated in certain localities in the Philippine Islands. The plant, called "abaca" by the natives, throws up a cluster of sheathing leaf-stalks to a height of 20 or 30 ft., which spread out at the top into a crown of huge, undivided leaves. It is cut down when three years old, and the sheathing stalks are torn apart and reduced into strips. These strips, when fresh, are

drawn between a knife and a wooden block, until, continued scraping by the expert natives, the soft, cellular matter is removed, and the fiber is then hung up to dry in the open air until it is ready for use. Each stalk yields about 1 lb. of fiber, and two natives, cutting down and scraping, will produce only 25 lbs. per day. The fiber of the outer layer is hard and strong; that from the inside is fine, thin and weak, and is used by the natives in making articles of dress. The whole supply of Manila hemp practically comes from the Philippines, and the United States consume 41 per cent. of the export. In 1897, out of 825,028 bales exported, the United States took 417,473 bales; Great Britain imported 385,182, and the Continent of Europe 22,373 bales. It is the most valuable of all fiber for cordage as it possesses great durability and strain-resisting power. Manila rope is now frequently adulterated by an admixture of New Zealand flax and Russian hemp.

Is Limestone in Concrete Injurious to Iron?

At the last meeting of the American Society of Civil Engineers, Mr. L. L. Buck stated that limestone in concrete, applied to iron or steel surfaces, would certainly cause deep corrosion of the metal wherever the stone came in contact with the metal. In the anchorages of the Niagara railroad suspension bridge the strands of the main cables were imbedded in a concrete made with limestone, and wherever the spalls touched the wires the latter were badly eaten and sometimes entirely severed.

This is a matter of such importance that it deserves careful attention, particularly in view of the use of limestone in concrete laid in connection with the structural metal work of large buildings, where corrosion can be detected only with much difficulty. There is a wide variation in limestones, and it may be that some grades will act corrosively and others not. It is desirable that this point should be borne in mind in discussing the subject.—Engineering Record.

CEMENTS AND LIMES.

Relative Merits of Limestone and Lime in Blast Furnace Practice.

At the spring meeting of the British Iron and Steel Institute a paper on the above topic was presented by Charles Cochrane. The paper contains the results of a comparison of limestone and lime (1896-97) employed as flux* at a furnace 90 feet high, of 31,659 cubic feet capacity (as originally constructed), enlarged by wear to about 34,500 cubic feet capacity, at Ormesby Iron Works, Middlesbrough. The failure of a kiln employed to calcine limestone necessitated the substitution in November, 1896, of raw flux for calcined, and afforded the opportunity to compare the working of a furnace under the altered condition. In commencing upon the comparison instituted between the average returns of the four months, September and October, 1896, May and June, 1897, and those of the six months, November, 1896, to April, 1897, no one could fail to be struck with the general uniformity in the leading conditions of quality of coke containing 11.09 per cent. of ash, sulphur, and water in the four months, and 11.56 per cent. in the six, of quality of raw iron contained in the one period 26.74 per cent. of ferrum, against 26.96 per cent. in the other; of temperature of blast only differing the two periods by 15°, of pressure of blast 5.04 pounds, as against 4.97 pounds of output of iron, showing 101 tons per month in favor of the period during which the flux was partly calcined. The ratio of CO₂ to CO had been disturbed by the employment in May and June, 1897, of a considerable amount of extra coke, so that a comparison be-

tween these was slightly disturbed, but not to an extent to interfere seriously with the deductions which arose therefrom. The points of difference between the two periods were:

(1) Reduced consumption of coke when calcined flux was employed, showing an economy of 1.03 cwt. per ton of iron, and, be it observed, with a low percentage of carbonic acid from 13.96 cwts. of limestone, from which $8.92 - 2.93 = 5.99$ of calcined flux and 5.04 raw limestone proceeded. Although the 5.99 of calcined flux were obtained from $13.96 - 5.04$ of limestone, *i. e.*, from 892 with a loss of 33.84 per cent. of carbon dioxide, its admixture of 5.04 raw limestone reduced the real loss of dioxide of carbon on the 13.96 cwts. total of limestone to only 20.99 per cent. (2) Reduced waste of raw ironstone per ton of iron from 2.06 cwts., in the period when limestone was used, to 0.66 when imperfectly calcined flux was employed, a difference of $2.06 - 0.66 = 1.40$ cwt. of raw ironstone per ton of iron. When raw limestone alone was employed, the waste of raw ironstone rose to 2.06 cwts. per ton of iron, and such waste would appear to arise from the circumstances that raw limestone descended much farther down into the furnace when this was employed instead of a lime kiln, than did partially calcined flux. How serious was the loss of fuel when limestone was employed, was indicated in a difference of 1.03 cwt. of less coke expended when the calcination was only 20.09 per cent. The author further showed that in the six months, November, 1896, to April, 1897, during which 13.91 cwts. of raw limestone were employed per ton of iron, there were

needed 2.37 cwts. of carbon to expel the whole of the carbon dioxide. Also that the direct loss to the furnace by the use of the raw limestone amounted to 6.20 cwts. of carbon. He remarked that at first sight it would appear that even with 20.99 degrees of calcination there should be an economy of 3.20 cwts. of carbon per ton of iron over the consumption needed when the raw limestone alone was employed. But (3) when raw limestone was employed in the case under consideration of a large blast furnace of between 34,000 and 35,000 cubic feet capacity, there was by reason of the employment of limestone a larger production of carbonic monoxide, due to the treble cause of (a) extra absorption of carbon by CO_2 of flux, (b) extra fuel needed to compensate for the loss of heat occasioned thereby, and (c) the fuel needed for the expulsion of carbonic acid.

Sir Lowthian Bell, in opening the discussion, said that there was not much to be gained by lime. If the calcination of the limestone were so great an advantage why did Mr. Cochrane use one-half of the limestone raw? If the limestone which was calcined were only half calcined, that meant that one-half of the carbon dioxide remained unremoved; and one would suppose that, if they could draw out all the carbon dioxide, then, instead of saving rather more than 1 cwt. per ton of iron, they would save about 4 cwt.

Mr. Charles Wood said that for the past twenty-seven or twenty-eight years he had worked on this system of partially calcining the limestone. He found it more economical, and also that he got better heat in his stoves and a better gas in his boilers, and that the furnaces worked better. Mr. Cochrane had shown that he saved a considerable amount of coke; that the furnaces worked better; and that there was a remarkable economy. Then came the saving of 1.40 cwt. of ironstone. He confessed that that had rather taken him by surprise. Where had that 1.40 cwt. of ironstone gone to? Mr. Cochrane did not account for it. He looked to the slag to see if the slag had increased at all by this saving of the ironstone. But Mr. Cochrane showed that there was less slag,

and he had also shown an increase of 2.90 cwt. of coke to the ton of metal during the last year or two. It would be in the recollection of the meeting that Mr. Cochrane read, a few years ago, a paper showing that he made his iron with $18\frac{1}{2}$ cwt. of coke to the ton of metal. From 1883 up to 1890, when Mr. Cochrane showed a consumption of $18\frac{1}{2}$ cwt. of coke, he was not calcining his limestone, nor had he been calcining his limestone during six months of 1896-97 when he gave the coke consumption at 21.45 cwt.—a difference of 2.90 cwt. of coke. That was a remarkable increase in the coke. Where was the difference? And why should it have gone up so—working, as he said, on uncalcined limestone? In the period in which Mr. Cochrane was working with $18\frac{1}{2}$ cwt. of coke, he was using the very best class of ironstone produced out of the Cleveland Hills, which he believed would give 33 per cent. It was therefore the difference between an ironstone containing 33 per cent. of iron and an ironstone containing 26.75, which had increased the coke consumption by 2.90 cwt.

The Portland Cement Trade in the United States.

The condition of the cement industry in this country is very active. The cement mills now in operation in this country have found the greatest drawback in not having sufficient cement to supply the demand. The Eastern mills in the past five years have always run short of cement to fill their contracts in the early spring.

The production of Portland cement in the United States during the year 1896 amounted to 1,543,023 barrels, as compared with 920,324 barrels in 1895, an increase of 552,699 barrels, or nearly 56 per cent., which sold at an average price of \$1.50 per barrel, in bulk, at the mill. This extraordinary increase taking place largely in the Lehigh regions. In 1896 there were twenty-six mills in operation in the United States and the imports of Portland cement for the same period was

2,989,597 barrels, a slight decrease over that of the preceding year. The amount of cement importeed for the last six years has been remarkably uniform, the total for 1896 being almost equal to that of 1891, the percentage of total consumption having grown from 3,443,126 barrels to 4,447,134 barrels in 1896, an increase in five years of over 1,000,000 barrels, notwithstanding this being a period of general business depression.

In the United States at the beginning of the year 1897 there were eighteen factories manufacturing cement from limestone or rock and producing 1,203,234 barrels, eight factories using marl and producing 334,789 barrels.

The estimated production of Portland cement in the United States for 1897 was 2,304,300 barrels. The imports of Portland cement into the United States for 1897 was approximately 2,255,810 barrels, showing that there is room for a large increase in the American cement industry. In addition to this there was produced in the United States in 1897 about 7,970,450 barrels of natural or Rosendale cement, a production of sixty-seven factories.

The growth of the consumption of cement given by periods of ten years is as follows:

Year.	Pounds per capita.
1850.....	6.46
1860.....	10.49
1870.....	12.77
1880.....	13.04
1890.....	33.93

These tables show a remarkable increase in the last ten years. Between 1880 and 1890 the increase in consumption was almost 200 per cent. over 1880.

The average price at which the natural rock cement was sold in 1897 in bulk at the mill, not including cost of packages, was 50.8 cents per barrel.

As it is universally admitted by engineers that one barrel of Portland cement is equal to two of natural, and in many cases to three, it can readily be seen that as soon as Portland cement is sold at \$1.00 at the mill, in bulk, natural cement manufacturers will be forced to the wall and 4,000,000 barrels per year of Portland cement could be used. This is

without taking into consideration the steady growth of the consumption of cement, which, as we have stated above, was 200 per cent. between 1880 and 1890. But supposing even the impossible condition that the cement consumption should not increase, there would be ample market to take up any increased production that may take place in the next ten years. Taking importations at 3,000,000 barrels and the natural rock production at the rate of one barrel of Portland to two of natural, would make 7,000,000 barrels to be consumed in this country, in addition to what the mills can already supply, or an increase in the daily production of about 23,000 barrels over the present daily production of about 5,300 barrels.

The very notable shortage of last fall has extended to this spring's trade and all of the Eastern mills have already contracted for their production at prices ranging from \$1.40 to \$1.65 per barrel, in bulk, at the mill. The daily consumption of Portland cement in the United States in 1897 was about 16,000 barrels. Assuming the consumption of Portland cement will continue to increase in the same ratio as in the past ten years, the American manufacturers will still have to displace 3,000,000 barrels of imported cement.—Observer, in Cement and Engineering News.

Portland Cement in Ontario.

A grade of Portland cement, claimed to be fully equal in point of excellence to the English, German, or even the Belgian product, is made of the natural deposit obtained from the bed of Shallow Lake, in the township of Keppell, Grey county, Ontario, nine miles west of Owen Sound, says Loton S. Hunt, U. S. Consul at Palmerston. Its manufacture was begun in 1889 by the Owen Sound Portland Cement Company, and was attended with very great difficulties at first, owing to the fact that very little was known about the processes of its manufacture, and suitable machinery was not readily obtainable. The lake floods every spring and fall to a depth of several feet, the water leaving, through fissures in the

bottom and rock-bound shores, usually about the month of June. Men and teams are then employed to remove a few inches of the waste surface, beneath which the marl lies to the depth of about three feet. Under the marl is found the clay, which forms the other ingredient and which is removed with the aid of a derrick, loaded on dump cars, and hauled to the factory on the shore of the lake. A large force of men and teams is usually employed for from six weeks to two months, in order to obtain sufficient material for manufacture during the ensuing fall, winter, and spring. The quality of the cement has been conclusively tested in the construction of the canal at Sault Ste. Marie and other waterways, as well as in buildings throughout the Dominion.

The supply of ingredients is practically inexhaustible, the lake covering about six hundred acres. The daily capacity of the factory is at present 125 barrels, which will be increased to 300 at an early date. The company was originally formed at Owen Sound, where the principal office is now located.

Prevailing prices are \$1.90 in jute sacks and \$2.10 in barrels, per barrel of 350 pounds, net.

Coldwater's Cement Industry.

Coldwater Mich.—Some idea of the extensive investment in Portland cement manufacture is had from the following: The factory at Bronston requires an outlay of \$200,000. The one at Union City three engines to operate it; one having a horse power of 75 the second 250, and the third that of 500.

The big plant now being built at Coldwater will cost \$150,000 and will be the finest equipped cement factory in the world. The supply of material, now proved to be of the best, is practically inexhaustible.

The English Method of Building Cement Sidewalks.

According to a journal devoted to the interests of carriage and footway construction, the proper English method of

building cement sidewalks is as follows: Excavate the ground to a depth of about five inches below the finished level, and upon this lay about one inch thickness of cinder or gravel; upon this lay a layer of clean, hard stone, or other suitable material, broken so as to pass through a 3-inch ring, well watered and rolled, filling up inequalities and leaving the surface about two inches below the level of the footway (sidewalk). Divide into bays (sections about six feet in width, with battens of soft wood), and complete each alternate bay by laying on the stone foundation carefully prepared concrete composed of one part Portland cement, two parts coarse, clean gravel, or other suitable procurable material, passed through a 1-inch screen, and two parts clean, sharp sand, which must be well beaten or rolled into place; and before it is set a finishing coat one inch in thickness of a finer and richer concrete to be added and brought up to the finished surface of the footway, and well troweled and smoothed into place. This finishing coat may be composed of one part Portland cement to two parts granite chip-pings, three parts gravel, or other suitable material which will pass through a $\frac{1}{4}$ -inch sieve. As the work is finished the battens may be removed and the joints filled with fine sand.

Cement Industry in Japan.

Japan has a growing cement industry, having made about 600,000 barrels (400 pounds each) of Portland cement, and about 10,000 barrels of natural hydraulic cement in 1897. The value of Portland cement was about four silver yen per barrel.

Louisville, Ky.—Cement dealers say that business in their line is steadily improving and a good business is expected.

The big cement works in Union City, Mich., will commence operations early this month. The three engines—75, 250 and 500 horse power—are in place; the balance wheel, weighing 30 tons, is on

its bearings; the big steam dredge, the locomotive and cars for the marl road are on the tracks, and comparatively little remains to be done.

H. L. Forte & Co. have been awarded the contract for the erection of six additional buildings to the plant of the Vulcanite Portland Cement Company, at Vulcanite Station, on the New Jersey Central Railroad, near Phillipsburg, Warren County, N. J. Two of the buildings are two-story and four one-story, the largest measuring 600 by 80 feet. The contract will aggregate about \$100,000.

The lime cask makers in the northeast part of Jefferson are receiving only 11 cents for casks, says the Damariscotta, Me. Herald, after hauling them to Thomaston, 18 or 20 miles.

John Shackleford and Will Cobb, two young farmers of Johnson County, pleaded guilty in the circuit court at Warrensburg, Mo., to obtaining money under false pretenses, and were fined \$25 and costs each. Last fall the two men buried a Portland cement woman on a farm in Hazel Hill township, "discovered" the object and exhibited it as a petrified woman, charging ten cents admission. They reaped a Klondyke of small change, but the fraud was exposed and they were indicted by the grand jury.

The oldest living lime-burner in the United States is said to be Amos Murray, a native of Ireland, who has burnt lime

at the Charlestown Landing, Ind., for the last fifty years. He is now seventy-five years old. Mr. Murray when he first began burning, received 20 cents a barrel.

The immense new plant of the Davis Portland Cement Company at Middlebranch, O., is nearing completion. Its size continues to be a wonder to all Cleveland, Canton & Southern railway passengers who have not yet seen it and notice it in passing along that route. A business man of Canton not connected with the company is authority for the statement that a second deeper vein of cement shale has been discovered which produces fine cement, and which it is believed will be of immense advantage to the new reconstructed and enlarged establishment.

White Pigeon, Mich.—Plans for a cement factory here are maturing, and it looks as though we would get it for sure. At a meeting of directors the following officers were elected: President, Wm. H. Coulter, Frankfort, Ind.; vice president, H. G. Watson; secretary, Den. C. Thompson, Cleveland, Ohio; treasurer, T. E. Clapp.

A cement for repairing granite is made by reducing to an impalpable powder equal parts of black feldspar and marble dust, and mixing in powdered gum dammar. Heat the mixture until the gum melts, mix the whole by stirring, and then apply to the fractured parts of the granite like putty is used.



TIMELY TOPICS

The Joliet Strike. President Madden, of the Western Stone Co., in a

notice posted to the striking quarriers at Joliet, Ill., says in substance :

1. The quarries will resume on basis of \$1.50 for ten hours' work. 2. Even at that rate the business of the company will not be profitable. 3. That pay is 2½ cents an hour more than a like character of labor receives at Joliet. 4. The product of the company is now only used in low grade construction. There is no demand for its high grade stone. 5. To pay \$1.50 for eight hours' work would bankrupt the company. 6. Competition and lack of building combine to prevent the profitable operation of the quarries now, it matters not what the rate of wages. 7. The company has not discovered how to pay 100 cents with 80 cents, hence the demands of the quarriers are unreasonable. Then he deliberately blunts every point in his argument by announcing that "the company will permit no further interference from outsiders in the operation of its works. The county, and state, if necessary, will be called upon to protect employes of the company and its property." It had been better not to have written that. It provokes belief that he is not sincere and truthful in what he proclaims. The menace is directed against a body of men who are now organized, who are under counsel of intelligent and experienced leaders, and who have the sympathy of the people who love peace and abhor in-

justice. That sort of a proclamation would have been timely three months ago, when the quarrymen in the Joliet region had to deal with the mob, but the mob has disappeared and in its stead has come an organization backed by the united power and influence of a federation that can wage a contest on equal footing with any opposition that can be brought against it in that section. Mr. Madden will learn this soon, if he does not understand it now. We counsel him to meet these men in a different spirit. The very fact that all operators but the Western Stone Co., and one or two closely allied with it, have accepted the scale of the men, leaves it an open question, at least, why the Western, which is more than half of the whole thing in stone quarrying in and about Joliet, cannot do the same without serious impairment of its business. President Madden's last annual review of his company's business seems not to bear out his contention that "it would mean bankruptcy" to his company if it were to concede the demand of the quarriers. "It produced stone cheaper in 1897 than ever before." "It does not owe a dollar." "It paid off \$8,000 of bonds and \$10,000 of mortgages in 1897." "It made a net profit of \$3,729.66 in 1897," and swelled "its available net surplus to \$128,369.07." Not a bad showing for a company that fears it will have to call on the constabulary and military forces to "save its bacon" to the amount of less than \$100 a

day that it is asked to distribute to its underpaid labor.

The Folly of Factions. The fool fellows who always become conspicuous in labor troubles—those in the trades unions and those among employers—have been much in evidence in and about Chicago during the past month. The peaceful triumph of organized labor over the quarrying companies in the Joliet section, whereby the quarriers have been compacted into an organization over 500 strong, and have brought about an alliance with stone-cutters and stone-masons, serves to show up the short-sighted policy of driving even ignorant and brutal foreigners, who make up the bulk of the number of quarriers thereabouts, to the last ditch. We are inclined to believe it was not more important to these low-class workers that they labor eight hours a day for \$1.50, or ten hours for \$1.75, but they stood out for the short day because they had learned that on that issue there was the best chance to deal out a return blow to the quarrymen who had for years won over them. It was the story of the brute driven to the corner where he could do nothing else than die or fight his way out. To their relief came the intelligent and experienced organizer, counseling peaceful methods and fidelity to a common interest. The fool fellow, in this instance, was the quarryman, who steeled selfishness against an humble appeal for more cordial treatment by the strong of the weak. He forced a reversal of conditions, and changed places with his former subject. All this will be for the best, so far as the stone trade in this section is concerned. Another lot of fool fellows are those who have put a lasting disgrace upon the honest stone-cutters of Chicago by committing murder.

John Finnegan's ghost will hereafter have a seat in the councils of the stone-cutters' union of Chicago. The former president of the union and his brutal compatriots who committed the deed of murdering one man and maiming others when they came to confer on peaceful measures affecting their organization and stone-cutters' union, did more to set back the progress of trades unionism, than a hundred strikes for trivial causes ever did. Neither the brutality of selfishness exemplified in the employer nor the brutality of the assassin exemplified in the ferocious laborite, will long be tolerated in a community of peaceful and law-abiding people. If the fool fellows on either side are not aware of this fact, they are likely to have the truth revealed to them in a very forcible manner.

The Padrone. Stone-cutters are demanding the passage by Congress of a law providing that only qualified citizens of the United States shall be permitted to work on Government contracts. This is urged that the padrone system, from which the stone-cutters are great sufferers, may be at least in part abolished. They do not object to this system because the men are foreigners, but because they work for low wages, so low that the American workmen cannot compete with them. Organized labor realizes that the wages of the laborer regulates his standard of living, and that if the standard be low the individual must be likewise, and they are right. Put up the bars against the padrones—they are up against the pauper—and the padrone is a thousand times worse than a pauper—for he rises no higher than his natural environment, while he serves as an instrument of the selfishness of men to degrade honest American wage-workers.

The War. It is costing the people of the United States a clear million a day to spank Spain into submission. That's about what it cost per day to preserve the Union a generation ago. Modern warfare is an expensive alternative. The more than a hundred millions already expended has not assuaged the hunger, or relieved the distress of a single Cuban reconcentrado for whom all this enormous expense is entailed. For all the priceless lives that have been sacrificed and the thousands of cripples that have been made, so far there is gain of glory only. Does it pay? For the dignity of the nation; for the good influence on the world's progress; for the future of liberty and enlightenment—yes, a thousand times, yes, this war has paid. For humanity's sake; for quick and necessary relief; for concentration on the prime object and purpose of the act, this war so far fails. Maybe it is thought by the powers that it is not the business of those who command warriors to dispense charity while the serious affair of dispersing the enemy is before them. If a stay-at-home citizen may be permitted the observation, we think the greatest victory the nation could achieve in this trying hour would be to give some of its wealth at once to the succoring of the distressed and dying non-combatants in whose cause it took up arms. A successful effort in that direction would make for peace more than the overthrow of a score of squadrons in foreign seas, or the capture of a hundred Santiagos. May we do both at the same time, but let us not forget the one desire in the pursuit of the other. If this is a war for humanity let us proceed on that line at least a little bit. Let us not give over all to the glory of the martial spirit—which not relaxing one particle, yet may be the agency to accomplish the greater victory. It has

not been shown this cannot be done, but it seems to have been forgotten we have it to do.

The Latest Move of the Monument Men.

Only a brief report from the inter-state convention of retail monument dealers at Council Bluffs, Iowa, has reached us in time for this issue, and is given on another page. Resolutions are said to have been adopted denouncing the "scalper," (whoever he is,) and putting a penalty on its members for having anything to do with him. Though we are not exactly informed at this writing of the identity of this much despised individual, maybe he is none other than the local retailer of monuments who has developed enough business energy and sagacity to grow to the proportions of a wholesaler also. We have "no crow to pick with him." Or, probably, he's the chap who, like the man without a country, goes whither he may to pluck in anybody's preserves—offering his wares for a margin of profit that will cover him safe to the next stopping place—in fact, the tramp in the trade—the lightning-rod agent disguised as a vendor of monuments. No wonder the legitimate retailers seek to combine against him. He's a nuisance, and the marvel of it is, that he subsists at all—that he receives orders, and that wholesalers and manufacturers accept his orders. Perhaps, he's the publisher of a trade journal, and sells advertising space for any old thing in the monument line. He's a hot old scalper, sure enough, but this Old Nick in the business is not numerous, if he is conspicuous and has his game dead to rights. Or, yet another, it may be the manufacturer's agent, who is set in competition against the manufacturer's former customers. He's legiti-

mate, if he's licensed, but who will blame the retailer for combining against him—he's a thorn in the sides of every one of them. He seeks business from the retailer at the same time he does not hesitate to poach on the trade of that retailer by selling direct to the local customer. STONE thinks the manufacturer would find it better business to confine efforts to building up a line of customers among the local retailers than in having their hired men following funeral processions, and invading the sanctity of a stranger's desolate home in quest of an order for a monument. But we do not impugn their right to do that. They have a perfect right to seek trade where they may, when they do it honestly. It's simply a matter of business policy.

LATER.—A copy of the resolutions above referred to have reached us. They are as follows:

Resolved, 1, That the National Marble and Granite Dealers' Association of the United States lend its energies to the establishment of a more satisfactory condition of business by securing to its supporters the co-operation of every responsible dealer in the nation, to the end that the granite scalper shall not be patronized. 2. That only such dealers as are members of the association shall be entitled to its protection. 3. That the manufacturer who sells work to any dealer not a member of the association shall have no standing with its members. 4. That any failure on the part of a manufacturer or a wholesaler to live up to the laws established for this association, and to assist us in our efforts shall entitle such manufacturer or wholesaler to none of the business of the members of said association. 5. That each individual member shall be held personally accountable for his acts and be compelled to answer to the association for any violation of such laws as it may hereafter enact.

We reserve comment on these resolutions for a subsequent number, with a preliminary statement that it is our belief that provisos 3, 4 and 5 cannot be enforced, because they are clearly illegal. Assent of members thereto may hold

the organization intact, but it would be impossible to enforce the penalties prescribed.

A Peculiar Situation. The statement by the president of the Western Stone Co., that the company cannot afford to pay its quarriers over \$1.50 for ten hours' work, is, no doubt, given in earnest, and in truth so far as stockholders in a profit-paying concern apprehend the truth in its effect on their financial interest. The stock of the Western Stone Co., has not in late years been a good investment as a dividend producer—it has not declared a dividend for some time—but it is a good investment nevertheless, because the company has been and is still adding riches to its holdings, and to its surplus fund. The astonishing thing about the statement referred to is that this consolidated company, virtually a trust, because it is nearly the whole thing in the production of Illinois limestone, is said to be unable to increase profits by reducing operating expenses. The reason given for this anomalous condition of affairs is that competition of Bedford stone, Cleveland stone, Anamosa stone, concrete, and the railroads have compelled the company to figure closer on large contracts. Small jobs are disdained, and it is on these the numerous individual operators have a chance to make the money they do, and pay better wages than the consolidated company is unwilling to admit it can afford to pay. Surely it is an unusual condition where a company with nearly every advantage in a business way, cannot produce and market its product in competition with concerns which enjoy none of the same advantages.



HALLETTSVILLE, TEXAS.

I am employed as foreman on the Lavaca County Court House; it is all stone, of a splendid design. C. H. & J. Statler, of Houston, are the contractors. Eugene Heiner, of Houston, is the architect. When completed will cost \$100,000. I have a tower to erect on it, and it is 140 feet high, all stone. I had the number of STONE which contained a description of the derrick Peter Holscher used in the erection of the tower on the Union Depot in St. Louis, and was so impressed with it that I will use it on this one. I must say that STONE is strictly up to date in every respect; it is a magazine every stone-cutter, as well as every contractor should subscribe for. It does more to advance our trade than any other journal in existence. We are just over a strike here, the men got all they demanded and are well satisfied. While our employer has a body of men that deserve all they get. The stone-cutters are on a strike on the new Court House at New Braunfels, Texas, for an advance in wages as well as shops to work in, and we are in hopes of an early settlement, which will be satisfactory to all concerned. Frank Fisher, of Austin, is the contractor, and J. Riley Gordon, of San Antonio, is the architect. Work in the stone line in Texas is improving.

The present war is keeping the most of the work back, but after we have ridden ourselves of the Spaniards, and are let alone by all nations, large and small, and when Dewey comes marching home again, there will be plenty of work in Texas for all who want it. Texas is one of the best stone states in the Union in proportion to her population, and came through the hard times better than most any state. We have court houses to build by the score just as soon as a little more money gets into circulation. Prospects for stone work never better than this spring, but this war cloud hung over us and is still here, and until it rolls away business will be dull. War may be a blessing in some cases, but it is hell on stone work.

JOHN KINNEY.

Hallettsville, Texas.

PARKERSBURG, W. VA.

The building boom in Parkersburg is unabated. It began early this spring and continues right along without cessation. Contractors and builders are rushed and their employees are making full time. The number of commodious residences is larger this year than any one year in the history of the town. H. S. Wilson will make extensive improvement on his home. A handsome three-story addition, with red granite front, polished granite columns and other adornments will be erected,

and it will be one of the very finest residences in the city when the improvements are made. Bids were opened on the 12th for quite a big job of sewer work. The bank job was awarded to Daniels & Brown Bros.

Parkersburg, W. Va.

STOYLE.

CLEVELAND, O.

Since my last report trade has been 'picking up' steadily in small jobs and contracts, so that at this writing all hands are working, and when one job finishes up it is an easy matter for men to get another one; something unusual for this city since the spring of '93. Three large business blocks have been started, but we shall have to be satisfied with "trimmings only" on them. No entire stone jobs have come out, nor are they expected this season unless the school council will wake up and get the two high schools started this fall.

Marble trade very dull just now, both at Norcross' and Cuyahoga Marble Works.

Wade Memorial will not be let until fall, as the foundation has just been finished and will be allowed to settle before superstructure is built.

GEORGE.

Cleveland, O.

ROWLESBURG, W. VA.

Regarding our business prospects for this season, they are good. We have just filled a contract for the stone work on the new addition to the Johns Hopkins Hospital of Baltimore. This quarry has furnished over \$2,500 worth of stone for that building or buildings, as there are a group of them.

We are now working on a contract of flag paving, to be laid at our county seat, Kingwood, W. Va., ten miles from here, where we are to put down one mile of walk this summer. We put in our time last year stripping and now have over 50,000 cubic feet of stone to place on the market.

We run three quarries of forty-three acres. All of them are of the same color and quality—Blue Devonian sandstone. But we are only operating the one quarry this year. Until within the past two years these quarries were owned and operated by Baltimore capitalists, who never looked after any trade outside of Baltimore, Washington, and Philadelphia. We are building up local trade which we find fully as profitable as the trade at distant points. We are arranging to put in saws and other machinery to supply the demand we have daily for contract work.

The first stone taken from this quarry was used by the Baltimore & Ohio Railroad Company in 1852 in building the abutments and piers for the bridge across the river at this point. The stone in this work is as perfect and is harder than when taken from its native bed.

This county abounds in fine building and limestone. On Cheat river grade, just three miles west of here, are the famous limestone quarries of Daniel Baker & Co., of Buckeys-

town, Md. This vein of limestone is over 150 feet thick. There is also—just across the river from here—a 40-foot vein of the finest brown-stone, which has never been opened but shows out on the face of the hill.

RIGHMEYER & SHOCH.

Rowlesburg, W. Va.

BEDFORD, IND.

The Bedford Belt Railway is putting in a foundation for a blacksmith shop and boiler room.

The Salem & Bedford Stone Company have a big job of cutting.

The Bedford Steam Stone Works have a job of cutting; the mill is running twelve hours.

The Hallowell mill is to start the first of the month. It has been idle for two years. I understand they are going to do stone-cutting.

Bedford, Ind.

EDGAR.

SAULT STE. MARIE, MICH.

A school house is to be built here, to cost \$16,000; it will be let in July; brick with stone trimmings, with one or two other small buildings of brick.

The water power bids will be open July 15. There is every appearance of it going ahead soon; they have to make a start fifteen days after the bids are opened, whoever gets the job.

Sault Ste. Marie, Mich.

MILLER.

LANNON, WIS.

Referring to the news item from Waukesha, on page 66 of the June number of your magazine, regarding case of Wm. Jaco's vs. Blair & Larsen, beg to advise you that the jury found for the defendants, finding the plaintiff guilty of contributory negligence.

A. J. BLAIR.

Lannon, Wis.

PEORIA, ILL.

Gleason & Son Company have secured the contract for the erection of the Incurable Insane Asylum building here. Their bonds are accepted and work is to be started July 1.

Bishop J. L. Spalding, of the diocese of Peoria, intends to erect a free high school for Catholic boys. He has leased the site and the building will be put up in the near future.

There is some street paving to be done this year, but not so much as last or the year previous.

SCALLY.

Peoria, Ill.

DAYTON, O.

The new flats on the corner of Ludlow and Third streets are going on with a rush. L. H. Webber, of this city, was awarded the cut stone work; it is of freestone.

The new electric line between Dayton and Eaton, Ohio, is in running order now. It is one of the finest electric roads in the Union. Twenty-three and one-half miles are now completed, but when it is finished it will be forty-two miles in length. There will be in a short

time another new electric line, to run between Dayton and Urbana, O. I will give you more information in my next letter.

There are several new residences projected, which will be ready in a short time for bids. The cost ranges from \$15,000 to \$25,000. We look for a busy season in Dayton.

Dayton, O.

D'ONOFRIO.

Cost of Steel and Wooden Freight Cars.

In figures recently made public by Chas. S. Schoen, of the Schoen Pressed Steel Co., Pittsburg, steel and wooden freight cars are compared in respect to first cost, cost of maintenance, durability and weight. Mr. Schoen compares a 30-ton wooden car and a 50 ton steel car, including interest and cost of maintenance, for the life of each car. The cost of repairs is averaged at \$40 per year for the wooden car, and at \$20 per year for the steel car, throughout a life of 15 and 30 years, respectively. He takes the first cost of the wooden car at \$525, to which he adds interest and cost of repairs for 30 years. He sums up a cost of \$106.50 during the life of the wooden car, or \$5.55 per year per ton carrying capacity. Then he takes a modern steel car at a first cost of \$810, allows the same rate of interest, and provides for repairs. From this he figures a cost of \$95.60 per year during the life of the steel car, or \$1.91 cost per year per ton carrying capacity. He estimates the difference in the cost per year per ton carrying capacity in favor of steel cars at \$1.64, which is equal to 46.2 per cent. Another advantage claimed for the steel car is the saving of dead weight. The estimate made assumes that train loads of 1,500 tons of paying freight are hauled, and that the wooden car weighs 16½ tons and the steel car 17. To haul 1,500 tons, 50 wooden cars are required, weighing 825 tons. To haul the same amount of freight 30 steel cars are required, weighing 510 tons. Thus the dead weight saved for train load in favor of steel cars is 315 tons. If 500 steel cars are used it will give 16⅔ full trainloads, which multiplied by 315 (tons of dead weight saved per train), gives 5,250 tons of paying freight gained for each run of the 500 steel cars.—Coal and Iron Trade Review.



SELECTED MISCELLANY.

The Ant and The Grasshopper.



YOU know the story, it's centuries old,
How the ant and the Grasshopper met, we're told,
On a blustering day when the wind was cold
And the trees were bare and brown.
And the Grasshopper, being a careless blade
Who all the summer had danced and played,
Now came to the rich old Ant for aid,

And the latter "turned him down."

It's only fancy, but I suppose,
That the Grasshopper wore his summer clothes,
And stood there kicking his frozen toes
And shaking his bones apart;
And the Ant, with a sealskin coat and hat,
Commanded the Grasshopper brusque and flat,
To "dance through the Winter," and things like that,
Which he thought was "cute" and "smart."

But, mind yon, the Ant, all Summer long,
Had heard the Grasshopper's merry song,
And bad laughed with the rest of the happy throng

At the bubbling notes of glee.
And he said to himself, as his cash he lent,
Or started out to collect his rent,
"The blamed young fool don't charge a cent,—
I'm getting the whole show free."

I've never been told how the pair came out.
The Grasshopper starved to death, no doubt,
And the Ant grew richer and had the gout,
As most of his brethren do.

I know that it's better to save one's pelf,
And the Ant is considered a wise old elf,
But I like the Grasshopper more myself,—
"Though that is between us two."

—Joe Lincoln in L. A. W. Bulletin.

The Philippine Islands,

As described by U. S. Consul O. F. Williams, of Manila, cover 150,000 square miles and have a population of 8,000,000 to 10,000,000. The Island of Luzon, on which Manila is situated, is larger than the states of New York and Massachusetts and has 5,000,000 population; the Island of Mindanao is nearly, if not quite, as large. In all, there are about 2,000 islands in a land and sea area of 1,200 miles in latitude and 2,400 miles in longitude. Of the hemp exports of 1897, 914,055 tons, 41 per cent. went to the United States; more than 55 per cent. of the 1,582,904 tons of sugar, exported in the same year, came to this country. The average annual value of hemp and sugar exports to the United States, for the last ten years, was \$8,926,372. There is but one railway in the islands, the 123 miles from Manila to Dagupin. This is a well built, single track line, with steel rails, stone or iron bridges and English locomotives making forty-five miles per hour. The government assisted in the building of this railway by granting valuable land concessions and guaranteeing 8 per cent. on the stock for 99 years. The road pays more than 10 per cent. per annum. There are about 25,000 Europeans in the islands, of which 12,000 are at Manila. Trade is in the hands of English, Spanish and German houses.

Building Material in Crete.

The search for building material among the ruins of ancient cities is a custom which in Crete has assumed incredible proportions. It may almost be said that stone quarries are an unknown thing on the island and that all the village builders, except in a few places which

are too far off from ancient settlements, work with second-hand material. One of the principal centers of the trade in the materials from ruins is the territory of Gortyna. The peasants usually have nothing to do but to excavate a half meter below the present level to find walls, which extend to a farther depth of two or three meters, and which when freed and taken to pieces give with but little work a profit many times greater than that of several years' cultivation of the land itself. The stones are sold to those who are building houses in the villages near the ancient city and also exported to the other villages of the Massara plain and to the neighboring provinces. The Turkish government, so zealous in preventing the work of explorers who come to carry on scientific work or excavations, pays no attention whatever to the work of destruction which is daily going on under its eyes. In fact, when it has public constructions to erect it goes so far as to procure its material by the very same system, thus often tearing down important monuments which disappear without leaving a trace of their former existence.

Dene Holes.

In chalk counties, and notably in Essex and Kent, "Dene Holes" are well known. They are bell-shaped caverns communicating by means of vertical shafts with the surface above; they are frequently clustered together, though not designedly connected, and are all constructed on the same general plan. Much archaeological lore has been gathered round them, and they have been described in some cases as corn silos, in others as hiding-places of the ancient Britons in time of war. Mr. Charles Dawson, F. G. S., who has given much time to the investigation of the subject, has prepared a paper on "Ancient and Modern Dene Holes and Their Makers," in which he shows, apparently conclusively, that these excavations are nothing other than chalk workings, carried out with the object of obtaining a local supply of that rock mainly for application to the land. In the center of East Sussex, in a very old-world district, an extensive area is covered with thousands of pits which resemble the dene holes of Essex and Kent. They represent the result of the usual method of procuring the limestone wherever this material is quarried from a depth below the surface of the ground. The workmen, who with their forefathers have been ac-

customed to this industry all their lives, perform the work with wonderful celerity. A well of three or four feet in diameter is sunk until it reaches the limestone at a depth varying from forty feet to sixty feet. The cavity above the stone is next belled out on all sides to a diameter depending upon the stability of the strata. The stone is then removed, and four small arched lateral chambers are dug at equidistant points in the side of the "bell" in order to extract as much stone as the pitman dare without endangering his life. The stone is hauled up by a man at the surface with the aid of a windlass of a primitive description and a handle of a peculiar curved shape which is characteristic. While the last pieces of stone are being removed from the pit another vertical shaft is begun about half a dozen yards away, so that it may be well forward by the time the other pit is worked out. Sufficient room is, however, always left to prevent one cavity from approaching too near to another, and thus endangering the stability of the surface. A further precaution is exercised in filling one pit with the debris from another. The empirical rule as to whether a shaft will pay for working is "a foot of dirt to an inch of stone." The deepest bed of limestone near Brightling is three feet thick. The price of the stone is 4s. per yard, and the men have to pay 1s. 9d. per yard as a royalty—1s. 6d. to the landlord and 3d. to the tenant. The workmen clear about 2s. 6d. to 3s. per day. Mr. Dawson argues with much force that in these modern workings we see the equivalents of the ancient dene holes.—*The Architect*, London.

French Trade Unions.

In 1896 there were 2,253 trades and labor unions with a total membership of 42,777 organized in France. There were also forty-nine chambers of labor (an institution which acts as a mediator and arbitrator in labor troubles and as employment and intelligence office for work people), embracing 1,047 unions and 166,886 members. For the establishment of these labor chambers over \$600,000 have been expended by the various municipalities. Most of them receive municipal subsidies (fourteen also department subsidies) for their maintenance. The costs for the establishment of twelve chambers have been entirely defrayed by the labor unions, and they have also been maintained by them. The trade unions have

established 100 traveling benefit funds, 330 sick benefit funds, 128 out-of-work funds. They also established forty-seven coöperative consumption associations and twenty-one societies of coöperative production, 142 school courses for manual training and technical instruction, 418 libraries, 380 employment offices and forty-two trade journals. The peasants are also well organized, having, in 1897, 1,371 agricultural societies and coöperative associations, with a total membership of 438,492. Furthermore, there are fourteen unions of agricultural wage earners organized.

In the Garden.

"Oh, dearest," said Adam, "'tis dark;
Do we go for a stroll in the park
On this clear dewy eve,
Do we dear, do we Eve?
Oh, we won't need a light, for we'll spark."

"Ha, ha!" laughed his sweetheart so true,
(The first of the women called "new,")
"I am pleased with your plan,
You original man,
And I don't care, Adam, if we do."

—L. A. W. Bulletin.

Nature Fertilizes—Man Impoverishes.

We can well conceive a time when the earth consisted of rock, water, and air. Mosses and lichens, frost and rain, took hold of the rock and crumbled it to dust. The lowest forms of grasses grew, lived from the atmosphere, and perished, adding humus to the soil. Higher types of grasses appeared, and so on from century to century, from age to age, till at last in the long periods characterized in the book of Genesis as a day, the earth was prepared for the herb-yielding seed, followed by animal forms, and these again by man, who was to have dominion over them all.

* * * * *

During all this period natural forces were at work dissolving the minute rock contents of the earth, developing available potash, phosphoric acid, and lime. The legumes in their lower and higher forms were drawing nitrogen from the winds of heaven and storing it in the earth. Myriads of microbes of countless species were at work tearing down vegetable and animal structure, and fitting it for the support of new plants and of higher types. Until man appears and goes to farming, nature is con-

stantly building up, fertilizing, improving making the soil richer and better. The constant fall of water from the high lands to the low tends to lower the water level and drain the land. The ants make their bed in the slough, and by their slow and toilsome processes raise a mound two or three feet wide and a foot and a half high above the level. In doing so they make their burrows clear down through the underlying hardpan to water. They are trying to drain that bottom. The gopher on the higher land digs down until he turns up the subsoil. He is doing his best work as a subsoiler. The earthworms are continually boring through it and passing the soil through their bodies and depositing it on top of the ground, gradually elevating and cultivating the field. Every force of nature seems to be at work to drain and enrich and fit the soil for the growth of grains and grasses adapted to animal wants, and these again adapted to supply the wants of man. It is only when man appears and tries his hand at "practical farming" that impoverishment begins.—Wallace's Farmer and Dairyman.

Aurora Borealis and Magnetic Storms.

The faint luminous arch seen at times in the night low down in the northern sky is the aurora borealis, or northern lights. Below the arch is what is known as the dark segment. The lower line of the arch is often irregular in outline, but is always well defined, showing a sharp separation between light and darkness.

During auroral displays there is a disturbance of the magnetic needle, causing it in middle latitudes to swing in half an hour three or four degrees, in extreme cases, from its average direction. The horizontal force of the earth's magnetism may change in the same time by one-ninth of its whole amount. These disturbances of the needle occur at very nearly the same time at places hundreds of miles apart. When the auroral light is rosy colored, the magnetic disturbances are said to be greater than when white. Such disturbances of the needle are called "magnetic storms." At such times there are also strong electric currents in telegraph wires and cables, interfering with their working. These may be due to earth currents or may be induced currents in the wire due to atmospheric conditions.

The aurora has many of the appearances produced by the passage of electricity through

rarified air in tubes. There is great uncertainty about the height of the aurora above the earth. The aurora may be such a phenomenon as the rainbow, for which every vision makes its own, and for which no height can be assigned. Various estimates and alleged measurements of the height vary from half a mile in the arctic regions to forty miles above the earth, and in the temperate zone, for the lower edge of the arch, as high as 100 or 150 miles.—Meteorology, by Thomas Russell.

How Stucco is Made.

Stucco is made by diluting very fine newly-baked plaster in a hot solution of white Flemish glue, so as to make a soft paste. Various coloring substances are added to the paste to imitate marble. These colors are the same as those employed for painting houses. When the mixture is dry it is polished with pumice stone and then with whetstone and tripoli. A final polish is given by rubbing it with a piece of felt and soapsuds and then with oil. With this imitation marble pillars, floorings, and children's toy marbles are made.—Science Francaise.

The Races Found in the Philippines.

Of the seven million inhabitants of the Philippines very few of whom are Spaniards, less than one-fortieth of them live in Manila, and about one-seventh of the entire population are believed to be unconquered natives. Among the natives are found representatives of several distinct races. The aborigines were probably the Negritos, a diminutive, dark-hued race, with features resembling the American negro. They are still found in limited numbers, a harmless nomadic people, very fond of the dog and of a cigar, which they frequently smoke with the lighted end in the mouth.

The aboriginal people were gradually conquered and driven into the interior by the invading Malays, whose descendants now form a large proportion of the population. The Tagals and the Igolotes are the most important of the Malay tribes, the latter being law-abiding and devoted to agricultural pursuits. The Tagals, with more war-like propensities, occupy the lowlands, living near the water in picturesque, elevated huts. They are in full possession of the interior of Mindanao, where under the sovereignty of their own sultans

they are free to enjoy the cock-fight, dancing, and music, for which they seem to have a great aptitude. They have strongly stockaded villages on the mountain sides, and while they acknowledge the suzerainty of Spain they do not pay taxes nor permit Spanish officials to reside among them.

Besides these two races there are in the Philippines Malay Indians and native Caucasians, with a large number of Chinese and Mestizoes. The laziness of the natives in times of peace is proverbial, but this is not to be wondered at when we know that nature has furnished the islands with a wealth of vegetation which may be used for food. Their indolence is probably increased by the climate, which is hot and enervating. The heat is, however, greatly moderated by alternating land and sea breezes, and a more healthful climate is unknown in tropical countries.—"The Philippine Islands," by John A. Osborne, in *The Chautauquan* for July.

The Roads and Bridges of Porto Rico.

Though for reasons of personal safety I was compelled, for a good part of the time, to avoid all well traveled roads, skirting them as best I could over country by-ways and cattle trails, I still had sufficient opportunity to test the quality of several of the larger roads traversing the island, among them the famous military highway connecting the one fortified city of San Juan with the center of the island and the port of Ponce on the other side. This road is not surpassed by anything I have traveled over in America or Europe. A bicycle corps could go over it without dismounting. The roads of Porto Rico are clearly not meant to be temporary affairs, but were built to stay. Their original construction must have been the work of unusually competent engineers, and the island authorities make it a point, evidently, to keep the condition of all the roads up to their first high standard of excellence. Macadamized as they are, they are kept in condition by the municipal authorities of each separate district, and their convex central road-bed is constantly brought up to its original level by fillings of gravel and cement, while the bridges and other stone masonry along the way are maintained in lasting good repair. Much of this labor is done by convicts. Almost all the bridges I had to cross impressed me as unusually solid and well built. Their arches were generally

strengthened by stone abutments where the current was strong, and where wood was used pains had been taken to select only such timber as would not rot under water or fall a prey to the wood worm. Crossing the river Loisa, near the capital in particular, I rode over a magnificent wooden bridge. From San Juan to Rio Piedras likewise I saw three splendid stone bridges, with piers and abutments. One of these crosses the branch of salt water which runs from the lagoon of Congrejos to the harbor of San Juan; the other bridge, with a redoubt at one of its ends, crosses the branch of the sea which communicates with the harbor and cuts off the island on which the city is built.—From "Porto Rico as Seen Last Month," by Edwin Emerson, Jr., in the American Monthly Review of Reviews for July.

The Gas Engine as a Rival of the Steam Engine.

It is scarcely more than a few years ago that the gas engine was looked upon by engineers as of no practical utility except for small power, and then under special conditions. In such instances the extra cost of fuel was more than balanced by the avoidance of a boiler, and the less attention required. For the purpose named the gas engines came to have a very respectable backing and it stands its ground firmly to-day. It was not till still later that it was thought to be practicable to employ it for power of 100 to 200 horse power, as it is being employed at the present time.

While it does not seem probable that the gas engine will, for large powers, supersede the steam engine or become a formidable rival, it is but fair to say there is a possibility of its doing so for the following reason:

While it is true that heat and mechanical work are mutually interchangeable, it is equally true that the value of heat as a means of—the only means of—mechanical power depends upon the difference between initial and final temperatures. Power is had through the change from a higher to a lower temperature, and in no other way. The first of the statements is in accordance with the first law of thermodynamics and the second in accordance with the second law.

In the steam engine the initial temperature is that of the steam in the boiler, which if the pressure (absolute) is 15 atmospheres—and it is rarely so high as this—is less than 400 degrees,

and the final temperature is the temperature in the condenser, which is more than 100 degrees. The difference between the extremes of temperature is not great.

In the gas engine the range between the initial and final temperatures is several times as great, and in this lies the possibility of greater economy. There are various reasons why this increased range of temperature cannot be utilized for power purposes, and while the objections may not appear to be unsurmountable, a way may possibly be found around or over them.—Tradesman.

The Trade Journal.

If you want to borrow money of a man, would you go to him when you knew he had it, or when he was dead broke?

If you wanted to marry an heiress, would you "ask papa" when he had had a terrible day in the wheat pit, or when he was comfortably filled up with good things to eat and drink?

If you wanted to get a man into a "quiet little game," would you tackle him when he was alone, or when he was on the way to church with his wife and his mother-in-law?

There's a proper time for all things.

The proper time to make a business proposition to a man is when his mind is on business, when he is right in the thick of just the business you want to talk about.

When a man sits down and commences to read his trade journal his mind is on just the business you want to interest him in.

The question of what to buy and where to buy it is one of the things he depends upon the journal to solve.

If you have anything to sell him, and your ad. isn't there to tell him all about it, some other fellow's will be.

That's why the other fellow gets the trade—and it's quite reasonable, proper and just that he should.—Chas. Austin Bates.

Skyscraper Materials.

An idea of the amount of material required in the construction of a modern office building can be secured from the following figures furnished by Charles McCaul, who has charge of the construction of a 16-story skyscraper in Philadelphia:

About 8,000 cubic yards of excavations, 4,000 yards of concrete and stone masonry, 4,371,5

pounds of steel, 300,000 pounds of ornamental iron, 36,000 pounds of ornamental bronze, 10,000 cubic feet of granite, weighing 900 tons; 260,000 square feet of fire-proofing, weighing about 3,600 tons; 1,360 tons of patent mortar used in plastering to cover 42,000 square yards of plastering; about the same amount of cement mortar used in brick and stone masonry; 40,000 square feet of Pavonizza, Numidian and Italian marble, 15,000 pounds of nails, 10,000 cubic feet of terra cotta, weighing about 290 tons; 325,000 face brick, 1,500,000 common brick, 24,000 square feet of glass, weighing about 73,660 pounds; about thirty miles of electric piping to encase the electric wiring throughout the building, and about ten miles of plumbing and steam-fitters' piping. There were on an average 200 men working on this structure from the start until the finish.

A Fickle Memory.

"There was a narrow, winding trail along the canyon," remarked an old prospector who did not become infected by the Klondike fever, "and I was picking my way as best I could when I was startled by a loud blast just ahead of me on the face of the cliff. I stopped just in time to avoid the torrent of stones and boulders that came rushing down. While congratulating myself upon my narrow escape, I saw that a man had rolled down the cliff side into the stream that ran through the canyon."

"Wul, by gum!" ejaculated the party as he was hauled out dripping wet. "A narrow escape," said I, seeing, with the exception of a few bruises, he had escaped injury.

"Stranger," said he, d'ye ever happen ter think thar wuz something ye had forgotten and yet fer the life of ye ye couldn't remember what hit wuz?"

"Any number of times," I answered.

"Wul, that was my fix jes' now. Ye see I've got a mine up thar, an' this morning I put in a blast, and jes' ez I wuz gittin' ready ter scoot, hit suddenly struck me thet I had fergotten

something, but what thet thar something wuz I couldn't remember fer the life of me! Wul, while I wuz settin' thar a ponderin' that there blast went off, an' then hit suddenly struck me what hit wuz thet I'd forgotten."

"What was it?" I asked.

"Wul, the fact wuz I'd fergotten that I'd lit the fuse of thet thar blast!"—*Detroit Free Press.*

Population in Manila.

It is difficult to make even an approximate estimate to-day of the numerical population of Manila, but it probably consists of from 270,000 to 300,000 souls. The largest proportion of these, excepting the natives themselves, is composed of Chinese and so-called Chinese natives, exceeding even that of the Spaniards. There is a large colony of Germans and Swiss, who according to rumor, are mainly responsible for the present and recent uprisings, and also a handful of Scotch-Englishmen; not too small a handful, however, to maintain an "English Club" in the suburbs and a "Tiffin Club" down town. The saying goes in the Far East that if an Englishman, a Spaniard and an American were to be left upon a desert island, the first would organize a club, the second build a church, and the third start a newspaper.

Half a dozen Americans are all that remain in Manila now, in sad contrast to the "old days," when two great American business houses flourished only to go down almost together with a crash that was heard around the world. What is now the English club house was built by one of these great houses for its "junior men;" and on its back veranda white—very white—men "lie off" on Sundays and holidays, and watch the cocoanut rafts drift by from the "enchanted lake," and read six-weeks-old papers and dream of New England pines and Scottish heather, ten thousand weary miles away.—From Frank Leslie's *Popular Monthly* for July.

BOOKS AND PERIODICALS.

"THE HAPPY SIX," by Penn Shirley, author of "Little Miss Weezy Series," "Young Master Kirke," "The Merry Five," etc. Cloth; illustrated. Lee and Shepard, publishers, Boston.

In this the third volume of "The Silver Gate Series," "The Merry Five," by the addition of another and younger member to the club, have become "The Happy Six," and well they deserve the title.

The children are now given a chance to see a little more of the world, and the description of their trip from the Pacific shores to New York, and then across the ocean to France, and their travels therein, with its many funny incidents, will certainly interest and delight all who read the book.

"Penn Shirley is a very graceful interpreter of child life. She thoroughly understands how to reach out to the tender chord of the little one's feelings, and to interest her in the noble life of her young companions. Her stories are full of bright lessons, but they do not take on the character of moralizing sermons. Her keen observation and ready sympathy teach her how to deal with the little ones in helping them to understand the lessons of life. Her stories are simple and unaffected." Price, 75 cents.

The first article of an extremely important series entitled "The Evolution of the Colonies," by James Collier, of Australia, appears in Appleton's Popular Science Monthly for July. The prospect of the United States soon embarking on a system of colonial extension gives this series a special interest just now.

An interesting news item to the publishing world is the reorganization and incorporation, on July 1, of the Frank Leslie Publishing House, founded in 1855 by Frank Leslie, and since 1880 the exclusive property of Mrs. Frank Leslie. The President of the new company is Mrs. Frank Leslie, while Mr. Frederic L. Colver, who has managed the property for the past three years, is secretary and treasurer. Extensive improvements will be made in the printing plant and in all departments of Frank Leslie's Popular Monthly this fall.

The July impression of The Chautauquan, with its cover of cool, refreshing tints and a design suggestive of delightful recreation, carries its attractiveness to the interior as well. There is a host of timely topics treated entertainingly by competent writers, and the illustrative part is a specially commendable feature. Besides the regular space commonly devoted

to the general reading matter there are thirty-two pages of information concerning Chautauqua and other summer assemblies, fully and artistically illustrated with views of Chautauqua and vicinity. The frontispiece is a portrait of the late William Ewart Gladstone, and the department of "History as it is Made" faithfully mirrors the events of the month.

FOOD FOR THOUGHT, rare and well done, which is composed of selections that were original in the columns of the L. A. W. Bulletin and Good Roads, the wheelmen's organ, is a little book, but a big volume when you measure the richness of its contents. Anything that Sterling Elliott, Nixon Waterman and Joe Lincoln has written, put up as a sandwich, is savory and satisfying. This little volume of tid-bits will refresh the weary wheelman like a draught from a mountain spring. "Value, \$5; price, 5 cents." Sterling Elliott, publisher, 12 Pearl street, Boston.

RECENT PUBLICATIONS.

Report of the Bureau of Mines, Ontario, for 1898, volume seven, first and second parts. Gives statistics of mining lands and minerals, mines of Northwestern Ontario, mines of Eastern Ontario, Michipicoton mining division, the West Ontario gold region, notes on the petrology of Ontario, Clastic Huronian rocks of Western Ontario, geology of base and meridian lines, and a very ample compilation of matter of interest to the mining and quarrying industries of Ontario. Printed by order of the legislative assembly of Ontario.

Graphite as a Lubricant, scientifically and practically considered; also, its value as an accessory for engineers and machinists. Sixth edition, revised. Published by Joseph Dixon Crucible Co., Jersey City, N. J., for free distribution.

A most welcome addition to our list of exchanges is The Sculptor, a monthly journal in the interests of the sculptor's art, and published at 20 Bucklersbury, Queen Victoria street, London, E. C., Eng. It is modest in size, elegant in an artistic way, and comprehensive in interesting subject matter. It contains original articles on Ancient and Modern Sculpture, and a large amount of historical, biographical, anecdotal and humorous matter of pertinent interest to sculptors, carvers, monumental designers and architects. Subscription, postpaid to America, \$2.

MACHINERY AND SUPPLIES.

[Matter appearing under this head is compiled and edited from data furnished by the advertiser, and should not be accepted as the opinion of the publishers.]

There has been a growing demand among belt users for a more convenient form of belt dressing than the paste. The Joseph Dixon Crucible Company, Jersey City, N. J., are now placing on the market a solid belt dressing in round bars, about eight inches long and two inches diameter. It makes a package convenient to the hand, and easy to apply even to fast running belts. The company does not claim that the solid dressing is as good a preservative of the life and elasticity of the leather as the Dixon paste, but it is quick to apply and quick to act, and that is what is wanted by the general run of belt users.

If you are not acquainted with the latest principle of dressing stone, and want information of its practical operation, address The Rapid Stone Saw Co., 630 Bourse, Philadelphia, Pa.

Dorset Mountain marble has been known and valued as the choicest of Vermont's variegated and white product for nearly a century. It is especially recommended as a decorative building material. Hundreds of prominent public and private structures in Eastern cities are decorated with it. Ask the Dorset Mountain Marble Co., of East Dorset, Vt., for specimens and information concerning it.

Good roads are next to godliness, for they mean cleanliness and comfort. The way to have good roads is to make them good in the first effort. The essential part of all good roads is a crushed stone base, whether in loose or concrete form. You can only have stone crushed properly by using modern machinery for the purpose. The up-to-date portable and stationary stone crushers are of the Austin and Western types—built designedly for producing material for rapid road building in country districts, and for towns and cities which can afford only a small-sized equipment. Send to Austin & Western Co., Ltd., Chicago, for large illustrated catalogue. It's replete with valuable information concerning road machinery and road building.

If you can't afford to buy new machinery, get your second-hand goods from a reliable dealer, whose word against them is something more than a putty patch. We know a couple such people in the business whom we confidently recommend—Thos. P. Conard, 119 So. 4th street, Philadelphia, and Willis Shaw, New

York Life Building, Chicago. One or the other, or both, have on their lists anything in stone-working machinery desired.

If you are a "raw hand" at quarrying, we advise you to take a free course of instruction in the use of powder, by applying to the Knox Rock Blasting Co., of Pittsburgh, Pa.

The original and standard material for fast sawing and rubbing of stone is chilled shot, first made, and still made in enormous quantity, by B. C. & R. A. Tilghman, of Philadelphia. This is a material that has not been de-popularized by the introduction of substitutes, and the challenge issued over ten years ago for a competitive trial with anything in cutting stone, is still unanswered—the best recognition of its incomparable excellence that could be given.

Put into your gaug a few of Wm. Clark Sons Co's quick-cut blades, and keep tab on them with any other make of blade ever used, and note the result. Write them at Pittsburgh, Pa., for circulars and prices.

Western quarrymen and mill operators will be pleased to learn that D. W. Pratt, of St. Louis, who has been known to them for so many years as an active manufacturer and dealer in stone-working machinery, while connected with the Chas. W. Melcher Machinery Co., and afterwards with the Moses P. Johnson Machinery Co., has started into the same line of business "on his own hook," at 211 Lucas avenue. He has taken the agency for several of the leading concerns of the country. What Pratt doesn't know about quarrying and stone-cutting machinery from the first bow-drill and bone saw to the splendid types of steam, air and electric machines now used in modernly equipped quarries and shops, is mighty little. He's as well qualified to give advice on the adoption of best machinery for specific purposes as any man in the country. Consult him when in need of sound advice regarding practical requirements in the machinery line.

The finest polished columns in red or gray or any other colored granites, any size to four feet in diameter and twenty in length, are furnished by the J. G. Mott Granite Co., of Pontiac, Ill. It's an advantage to procure such columns from a special manufacturer of them. Write to them for prices.

NOTES FROM QUARRY AND SHOP.

Allentown, Pa.—Penrose F. Eisenbrown, a well known citizen, in the 67th year of his age. He was born in this city. He learned the trade of a marble and granite cutter with his father in Schuylkill county. Afterwards he went in business for himself at Minersville, and later in Pottsville. He then moved to Reading, started the Eagle Granite and Marble Works, and continued in business for twenty-two years.

Kingston, N. Y.—Arrangements have been made for the settlement of the difficulties of the Kingston Limestone Company by the company confessing judgment and selling the property, which will very likely be bought in by the company. The employees, so it is said, have agreed to accept ten per cent. of the amount due them, the balance to be paid monthly or at stated times on account. As soon as a satisfactory settlement is made work will be resumed. One of the features of the snarl is what has become of the \$65,000 invested in the works. Of this amount \$35,000 was in cash and the balance is owed. About \$20,000 have been expended, and the plant, experts say, can be duplicated for \$14,000, thus leaving \$31,000 the disposal of which is a mystery.

The men employed in the big slate quarry at Rockmart, Ga., went out on a strike July 8th, and the industry is at a standstill for a while. The largest quarry in the place is operated by W. L. Craig. He employs about 30 men, most of them experts, and some negro helpers. The cutters and dressers are Welshmen, many of whom came from Wales years ago. In the prosperous days of the business these experts made from \$2 to \$4 per day, but only get \$1 now. As the industry is looking up, they think they should have more. The managers refuse to accede to their demands and the men walked out. Craig says he will employ other men. For many years Rockmart was the only place this side of the Virginias, where slate was quarried, but recently good deposits have been found near Cedartown, which is being worked with profit.

Joliet, Ill., July 12.—The stone quarry strike is still unsettled, and today the stone-cutters took a hand in the quarry strike by refusing to handle non-union stone. Several jobs were stopped, and the action of the stone-cutters means a practical boycott upon the output of quarries not employing union quarrymen and paying the union scale of \$1.50 for eight hours

work. There are only about 100 men receiving the union scale here, while about 200 are working ten hours for \$1.50. The Western Stone Company posted notices today that it would pay only \$1.50 for ten hours, but would protect all its men.

Application has been made for a charter for the Aetna Slate Company, recently organized to open a new quarry west of Pen Argyl, Pa. The incorporators are William J. Turner, president of the Lehigh & New England railroad; George K. Snook, of Bangor; George W. Jackson, Gustav A. Rumpf, and Leonard M. Addis.

Fulling Springs Quarry and Construction Company, East St. Louis, Ill., capital stock, \$5,000; incorporators, F. W. Hackman, Sr., Francis Kirsch and Fred Brandt.

Phoenix, Ariz.—Articles of incorporation of the Standard Quarrying and Construction Company were filed here by Walter J. Roberts, Henry E. Parsons and John F. Clark, of New York City; offices at Phoenix and New York City; capital stock \$1,000,000.

Lansing, Mich.—The Michigan Portland Cement Co., of Detroit, with a capital stock of \$2,500,000.

Eureka Red Slate Company, Mena, Polk County, Arkansas; capital stock \$10,000, fully subscribed. Incorporators, E. M. Cockrell, F. G. Cockrell, W. I. Boyer and K. M. Boyer.

A limestone quarry has been discovered on Joe Slama's farm, about two miles west of Milton, N. Dak. The limestone is said to be of good quality and the indications are that there is an immense quantity.

C. D. Rock and H. J. Meacham have opened a new marble and granite shop at Monticello, Illinois.

Hartford, Conn.—The Hartford Trap Rock Company is a new candidate for the crushed stone business of that city and vicinity. It is formed to work on a fine ledge of stone near the quarry of the Hartford Street Railway company under Newington Mountain. Preliminary work has been done at the quarry and foundations for the crushers are being built. The capacity of the works will be 300 to 500 tons a day. The ledge was discovered by James Goodrich and he is the manager of the

new company. The other stockholders are John A. Crilly and Charles M. Crawford of this city, E. S. Goodrich of Wethersfield and A. O. Crosby of Glastonbury. It starts with a modest capital of \$5,000, which may be increased as the business demands.

L. P. Giffroy, who is connected with the land department of the Mississippi Valley Railroad, with headquarters at Memphis, says that there is a large firm of cement manufacturers now operating an extensive plant in the City of Mexico, who are contemplating opening up a big plant at New Orleans. He says that application has been made for certain information appertaining to the city, its offerings for plants, locations, etc., and he suspects that in a short while several of the larger owners of the plant will go there and look around some. This cement manufactory, Mr. Giffroy says, is unlike all other factories in the country, because cement is made upon a new principle, and it is said to be better than any article which is being made to-day.

Lamar, Mo.—Joseph Ellis, marble, succeeded by W. P. Scott, Jr.

Albert Lea, Minn.—Frank Bessinger and Robert Kranebell have each purchased a third interest in the marble and monument business for the past twenty-two years run by M. Bessinger, father of the junior member of the new firm. The business will be transacted under the name of Albert Lea Marble and Granite Works, with Frank Bessinger, Robert Kranebell and M. Bessinger as proprietors, the firm name being Bessinger, Kranebell & Co.

The firm of Harriman & McFadden, Peru, Me., stone cutters, has dissolved partnership. Mr. Harriman will continue the business at the old stand. Mr. McFadden has gone to Rumford Falls.

Utica, N. Y.—Thomas & Jones have purchased the stone yard formerly conducted by E. Callahan.

New York, N. Y.—An attachment for \$3,833 has been issued against the New York Slate Works, at 138th street and Third avenue, in favor of Albert Martinez.

Cleveland, O.—The South Park Stone Company of Independence township, has given a \$15,000 mortgage to the Cleveland Trust Company. The mortgage is given on eight different parcels of real estate in Independence township for gold bonds bearing 6 per cent. interest. The money the company intends to use in the extension of its business.

Philadelphia, Pa.—Judgment was entered by the Brainerd, Shaler & Hall Quarry Company against James Mann and Walter L. Ronald, trading as James Mann & Co., for want of an affidavit of defense in a suit to recover upon two notes. Damages were assessed at \$2,113.16.

Covington, Ky.—A deed of assignment by

Kesting & Schuermann, stonemasons, for the benefit of creditors, was filed in court. Dull trade and slow collections are the reported causes for the failure.

Cincinnati, O.—Assignee M. T. Shine filed a schedule of liabilities of Charles McDonald, the marble man, \$28,791.34 in amount. Included is the claim of the Citizens' National Bank for \$5,500. Also real estate mortgage notes for \$10,000.

Prosecuting Attorney Lowe has brought quo warranto proceedings, at the instigation of Dudley Talbot, against L. M. Stewart, William Weston, G. S. Dean and Frank B. Weston, praying for a writ of ouster to prevent them from holding the franchise of the Weston Lime and Cement Company, Kansas City, Mo., which it is claimed they have unlawfully usurped.

Columbus, O.—The sum of \$268 in the hands of J. F. Townsend, of this city, was seized on an attachment issued in favor of the National Granite Company, of Washington county, Vermont. Lyman Stacey, the defendant, is a non-resident of Franklin county.

Terre Haute, Ind.—Bessie A. Owens, marble, reported to have recorded chattel mortgage for \$1,200.

Sigourney, Ia.—R. H. Wasser, marble and granite, reported to have given real estate mortgage for \$200.

St. Louis, Mo.—Selma Watson, quarry, reported to have given bill of sale for \$850.

New York City, Manhattan, N. Y.—John R. Setz, stone, reported to have given judgment for \$1,039.

White Lake Corners and Northville, N. Y.—White Lake Granite Co., gave judgment for \$137.

Avondale, Pa.—Avondale Marble Co., reported to have given judgment for \$148.

Sunbury, Pa.—Wm. M. Daugherty, marble, reported to have given judgments for \$300.

David Brown, of Warrensburgh, N. Y., has opened a marble quarry on the farm of Josiah Hammond, in the eastern part of the town of Warrensburgh. He discovered the deposit about eight years ago, but owing to counter claims on the property has been unable to do anything until the present time. The stone is known to the trade as gray marble, and it is beautifully streaked and mottled with green, and is susceptible of a high polish. A company has been formed, known as David Brown Sons & Co., to open the quarry. Work will be begun at once on the erection of a saw mill and derricks, and later this season a cutting and polishing shop will be built. Quite a large number of orders have been received from samples which have been sent out.

Logansport, Ind.—Things are lively at Kenneth quarries at present. The demand for the output is in excess of the capacity and work is being pushed with a will. The superintendent has been short of men.

Denison, Tex.—Charley Sheaffer, contractor for the National capitol building of the Chickasaw nation, now under construction at Tishomingo, brought a six-foot column of granite to be polished for the columns in the front of the capitol building. The granite is the Chickasaw product, quarried within two miles of Tishomingo, and, Mr. Sheaffer says, will take on a polish as fine as any granite in the world. He considers this quarry one of the best in the West anywhere and his quarriers and stonemasons say it is as fine as can be found.

A Roman road, twenty-four feet wide, paved with gray granite, in some places of great thickness, and resting on a bed of concrete, has been discovered at Lyons, France. Near it is a subterranean passage, the roof of which has fallen in. It seems to have connected the governor's palace with the amphitheater, of which remains have been found in a field. The passage is eight feet high and two and one-half feet wide.

Velp, Wis.—A call at the various offices of business indicates that a boom is now on. The Northwestern quarry reports two hundred laborers and fifty stone-cutters now at work and more men will be put on shortly. Twenty carloads of stone daily constitute the output. The Pireaux quarry has the Suamico bridge. M. Brunette's quarry is running full blast. The Gillen quarry is also in operation, and a large crusher is daily turning out crushed stone for pavement work.

The Frontenac (Minn.) Stone Company has contracted to furnish 150 carloads of stone to be used in building the new Cathedral of St. Stephen's Church, in New York City. This is only a portion of the stone to be used, but enough for this year's work.

The Vermont Marble Company, Proctor, Vt., paid its employees \$47,000 for May wages.

Consul General Goldschmidt says that the area of carriage pavements in Berlin is 6,500,405 square yards. Of this a fraction less than 74 per cent. has stone pavement, about 25 per cent. asphalt, and a fraction over 1 per cent. wood pavement. The proportion of asphalt is steadily increasing. The soil consists of coarse, gritty sand, forming apparently an excellent foundation for the heavy 8-inch layer of gravel and cement, over which the 2-inch covering of asphalt is spread, making a strong and durable pavement. The average price of asphalt pavement in Berlin is \$2.80 per square yard. The city government grants the contracts for laying the pavements, and also for keeping them in repair for twenty years, the first five years without extra compensation, and after that for an annual compensation of 10 cents per yard.

East Longmeadow, Mass.—Business among the quarries is decidedly improving. The Norcross firm has taken orders and contracts from New York. The James & Marra quarry has reopened with a force of men at work on full time.

On Hewett's Island, off Spruce Head, Me., a crew of quarriers have commenced to quarry bridge stone. It has been thirty years since stone was quarried there before, but the Courier-Gazette thinks a hundred or more men will get employment on the island the present summer and fall.

Portland, Conn.—Work has been resumed in the Brainerd, Shaler & Hall quarry. All of the old hands were given employment.

The Rockcastle Stone Company, of Langford, Ky., have closed contracts in New York for several stone buildings, for which they will receive more than \$100,000.

Decatur, Ind.—Our stone quarries are being opened again.

Anamosa, Iowa.—Mr. James Lawrence has closed a contract with the C. & Q. Railway Company for the furnishing of two hundred carloads of cut bridge stone for the elevation of its tracks in Chicago. This is a good job and will keep Mr. Lawrence and his quarriers busy for some time. Mr. Lawrence's success against Joliet competition is quite a feather in his cap.

Fountain, Ind.—The stone quarry is running in full blast at present.

Sandusky, O.—A few days ago workmen who were plowing up Wayne street, preparatory to paving, found a large blue granite boulder near the corner of Market street. It was of fine grain, and of a variety quite common in the mountains north of the St. Lawrence river. It was probably swept down here ages ago by glacial action and lodged for centuries just where it was found. The boulder was about 2x3x6 feet, and its estimated weight about 1,500 pounds. A fire was built about the big stone, and the heat cracked it. The largest piece was removed and will be polished and used as a tombstone base. The glacial grooves, so prominent upon Kelley Island, Marblehead, and Lakeside, and traces of which may also be found near the old Monk shipyard in this city, were made by these heavy boulders being pushed along the limestone surface by the great glaciers of the ice age.

The Bodwell Granite Company, at Spruce Head, Me., is letting most of its stone-cutters go. The crew will probably be reduced to one blacksmith gang.

The Bodwell Granite Company at Jonesboro, Me., have nearly finished their contract for stone for the Buffalo postoffice, and will at once discharge part of their crew of fifty to seventy men, who have been on this job for over two years.

The Chicago Portland Cement Company has secured option on several hundred acres south of La Salle, Ill. Work on the plant to be erected will commence within a week or ten days. The principal owners of the stock of the Chicago Portland Cement Company are Norman D. Fraser, president and manager, and Ralph Gates, secretary and treasurer. The former is a son of Mr. Fraser, of the firm of Fraser & Chalmers, Chicago; and the latter a son of the president of the Gates Iron Works, of Chicago. The capital stock is placed at \$100,000. The building and the plant will be erected at a cost of \$100,000. The output of the mill will be 500 barrels per day at first, but the plans and specifications are so drawn that in the near future, if the business so warrants it, the buildings may be enlarged and the plant increased to double the capacity mentioned.

Baraboo, Wis.—The Chicago & Northwestern road has purchased a large stone quarry near Ableman will put a large force of men at work at once to build a track to it, and get the stone ready for use.

John A. Crilly is at the head of a company that is arranging matters of establishing a quarry and stone crushing plant in Newington, Conn.

Slatedale, Pa.—Lewis Fink, slate, etc., reported to have given judgment for \$666.

Piqua, O.—Flatz & Small, marble. Succeeded by Flatz & Eby.

The officers of the Brainerd, Shaler & Hall Quarry Company, Portland, Conn., expect that the quarry will be operated again soon, and hope to keep the quarry running steadily the rest of the year. It is officially stated that the company will begin work soon, and all old hands will be employed.

SITUATIONS WANTED.

Advertisements under this heading inserted for subscribers to STONE free of charge. Advertiser must send 25 cents to pay postage, if replies are to be addressed in care of STONE. Rate to non-subscribers, 10 cents per line each insertion.

WANTED SITUATION—Cut stone foreman desires position. Is capable of taking charge of all kinds of stone-cutting machinery. Have had 16 years' experience in cut stone business. Can give references from last employer, who has retired from business. Address FOREMAN, care of STONE.

SITUATION WANTED—By first class man as foreman or draughtsman on cut stone work. Has had large experience; can give all references; sober. Address P. A. J., care of STONE.

WANTED—Position; 16 years' experience as foreman and superintendent in general contract work, quarries and heavy masonry; expert on broken ashlar work. First-class references furnished. Address J. B. GORDON, Roscoe, New York.

WANTED—Situation as Superintendent or Manager of quarrying and cutting stone, or either. Understand all details of the work; can give references. Address CHAS. A. APPEL, Box

HELP WANTED.

Advertisements under this heading 10 cents per line each insertion.

WANTED—To learn the whereabouts of William J. Barber, at one time in our employ as yard foreman. Address THE CULVER STONE CO., Springfield, Ill.

HELP WANTED—A good, sober and industrious marble polisher, can fine steady work at fair pay, at ECKHARDT MONUMENTAL CO., Toledo, O.

TO SELL. TO BUY. TO EXCHANGE.

Advertisements inserted in this department for 15 cents per line each insertion.

MARBLE PROPERTY—Undeveloped. Fine gray and blue marble. Ideal water front and shipping point, mouth of Soo river on the great steamboat channel, 40 miles northeast of Mackinaw. Low freight, cheaply quarried. Rock bare, rising nicely from water's edge. Will give you a bargain on sale lease or royalty. Your correspondence and investigation invited. W. B. HOUSE, De Tour, Mich.

FOR SALE—Wardwell Channeler, double cutter. Practically new. F. G. SWINNINGTON, Rutland, Vt.

FOR SALE—By order of Court. Complete brick making plant of W. C. Hill Estate now running at good profit, nineteen acres of land, one mile from postoffice, Seattle, Washington. Price, \$20,000. WILLIAM H. LEWIS, Administrator, P. O. Box 52, Seattle, Wash.

D. W. Pratt

MACHINERY, Engines, Boilers, Rock Drills, Stone Saws, Air Compressors, Steam Pumps, Pulsometers, Hoisting Engines, Cableways, etc. Send for Special Catalogue. 211 Lucas Ave., St. Louis, Mo.

HOISTING ENGINES,

Locomotives, Relaying Rails, Air Compressors, Drills, Steam Pumps, Engines, Boilers, Stone Crushers, Etc.

NEW AND SECOND-HAND

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119 So. Fourth St., Philadelphia, Pa.

QUARRY PUMPS.



CHEAPEST. HANDIEST. SIMPLEST. PUMPS.

Handling Dirty, Gritty and Sandy Liquids, without Wear, Oil or Care. Pumping outfits for Contractors, Mining, Irrigating, Railroad, Quarry, Drainage and Manufacturing purposes. Second-hand Engines, Boilers, Pumps, and other Machinery always on hand. Exchanging.

MASLINS, 165-167 First St., Jersey City, N.J.

*Mr. Thomas A. Edison
examines a "New In-
gersoll" Rock Drill.*

*An order for 8 additional Drills
is the result. Making 15 in all,
for his Works at Edison, N. J.*



THE "NEW INGERSOLL"

(WRITE FOR CIRCULAR.)

Air Compressors—Rock Drills—Coal Cutters

The Pohlé Air Lift Pump.

The Ingersoll-Sergeant Drill Co.,

HAVEMEYER BUILDING, N. Y.

Business at the Chase Granite Company's works at East Bluehill, Me., is nearly at a standstill. About twenty men are employed, including quarriers, sharpeners, and apprentices. The Ellsworth American reports that the company has a contract for a small job, but the cutters refuse to do the work at the price offered.

The Westfield (Mass.) Marble and Sandstone Company is doing a rushing business at its Hinsdale quarry, and now has about thirty men employed in getting out marble for two government contracts. The marble is to be shipped to Washington and Milwaukee. The company has other large contracts, and has a gang of men working nights. The quality of the marble improves as the workmen proceed uncovering the upper layers, and the supply seems inexhaustible.

The Carbon Slate Company, of Slatington, Pa., exported during the month of June 11,408 squares of roofing slates, or 192 cars. Their largest single shipment was 7,179 squares, which required 120 cars to carry the same to New York, and which left Slatington in two sections. This consignment is the largest in the history of the slate industry. The largest one prior to this was shipped in May, 1897, by the same company and amounted to 6,252 squares, or 98 cars. This company has shipped during the first six months of this year 30,394 squares, or 530 cars; 28,109 squares having been sent to foreign markets and the balance, 2,285 squares, for home trade.

The disorder at the stone quarries along the Saugerties road and the threats and probabilities of violence are the direct result of the bringing here of a gang of ignorant and lawless men by a contractor who sought them out because they would work for lower wages than our home laborers could. Had local workmen been employed at living wages, the stone quarries would have been a benefit to the workmen and business men of Kingston. In nine cases out of ten when cheap labor is imported disorder and mob violence results when the men get dissatisfied and then the county is called on to spend money in keeping the peace, while those who brought in the disorderly elements have reaped the profit and the community suffers the double loss resulting from this expense and from home labor being thrown out of work.—Kingston (N. Y.) Leader.

The \$12,000,000 appropriation recently made by New York city officials for contract work has caused a boom in business at the "Klondike" quarries near Coblesville, N. Y. The company is adding new machinery and increasing its facilities with a view of employing at least four hundred men. The pay roll now registers 270. Manager Smith informs us that the company has contracts for work which foot up to \$3,000,000, among them a \$60,000 job for Erie work in Jersey City and another large contract for the Willis avenue bridge in New York

City. Schoharie county stone is accepted in all localities as a first-class article and the industry promises to develop into mammoth proportions.—Cobleskill Times.

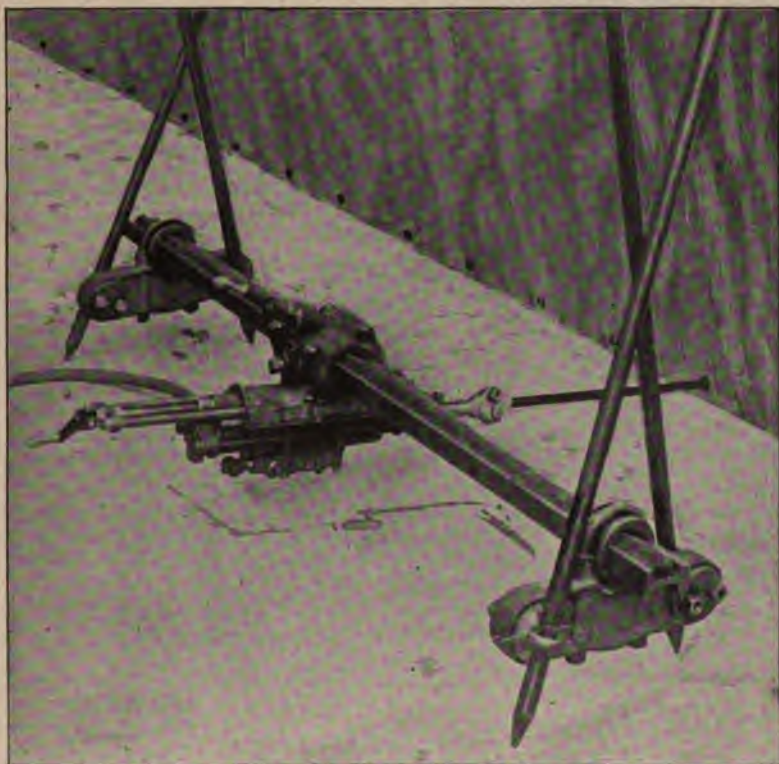
The slate shipments from the 1st to the 21st of June from the Pen Argyl quarries aggregated 150 carloads. The prices for small sizes are very low. The larger sizes, 10x20, 10x18, 10x16, and up, are in good demand and command fair prices. Foreign orders are all for large sizes, and take the cream of the production, leaving the smaller sizes on the bank. The home demand is not strong enough to use all the smaller sizes. Ocean freight rates are coming down daily.—Index.

The Maine and New Hampshire Granite Company have been awarded the contract for the construction of the Smith Memorial, which is to be erected under the auspices of the Fairmount Park Association, in Fairmount Park, in the city of Philadelphia. It is a monumental memorial to be built of the North Jay granite, and is to include equestrian statues in bronze of Major General George B. McClellan and Winfield S. Hancock, and colossal statues in bronze of Major Generals George G. Meade and John F. Reynolds, with bronze busts of Governor Curtin and Major General Hartranft, Admirals David D. Porter and John A. Dahlgren, General James A. Beaver, Major General S. W. Crawford, and in addition thereto busts of the architect, James H. Windrim, and the executor of the will of the late Richard Smith, the testator, John B. Gest. The design includes a mural tablet in bronze, with the inscription stating that the monument was presented by Richard Smith, type-founder of Philadelphia, "in memory of Pennsylvanians who took part in the Civil War." The testator directed that the entire expense of the monumental memorial should not exceed \$500,000. This contract alone will keep a large force of men at work at North Jay quarries for about eighteen months. It will require about six hundred cars to freight the granite to Philadelphia, at an expense of about \$30,000.

Washburn, Wis.—The famous brownstone monolith is no more. It was originally quarried by Frederick E. Prentice in 1892 for the Wisconsin exhibit at the World's Fair. The labor alone cost over \$5,000, but the money to transport it to Chicago was never raised. The monolith when completed measured 115 feet in length and nine feet at the base, being the largest block of stone ever quarried. It has lain in its bed of sand and water for six years, and as there seemed to be no probability of its being made use of in its original form it was sawed into blocks, and is being shipped to Menasha, where it will be used in the construction of a residence and barn. It has been visited by hundreds of people, and had Wisconsin been as generous in donating money for its transportation as the owner was in tendering it to the state, it would probably have been one of the sights at the Fair.

Sullivan Quarry Bars
Sullivan Gadders
Sullivan Rock Drills.

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THE SULLIVAN QUARRY BAR.

Channeling Machines for All Kinds of Work.

Contractors for

Prospecting Quarry Lands with Core Drills.

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339 Fifth Ave., PITTSBURGH, PA. 412 Seventeenth St., DENVER, COL.

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xi

The Keystone Granite Company, of Pacolet, Spartanburg county, S. C., has made application for a charter of incorporation. The capital stock is to be \$100,000, to be divided into shares of \$100 each. The following persons were commissioned as a board of corporators: James C. Johnston, Daniel Smith, both of Pacolet, and William S. Woods, of Pittsburg, Pa. The object of the corporation is to carry on a mercantile business and the mining and quarrying of granite and mineral substances and preparing them for useful and ornamental purposes. Mr. Johnston, one of the board of corporators, has been operating the quarry successfully for a period of five years or more.

Los Angeles, Cal.—The California Marble Company. The purpose of the company is to buy, sell and operate marble quarries. The directors are A. R. Sprague, E. Smead, R. A. Gutierrez, J. T. Houx, J. Rebman, all of Los Angeles.

Des Moines, Iowa.—The Krebs Brothers' Company, of Linn county, has filed articles of incorporation with Secretary of State. Its capital is \$3,000. Its business is to erect monuments and do other cemetery business. W. M., S. A. and C. A. Krebs are the incorporators.

Boston, Mass.—George H. Robinson, marble worker, reported to have recorded chattel mortgage for \$650.

Buffalo, N. Y.—Henry Hartke, Jr., stone, reported to have given judgment for \$135.

Buffalo, N. Y.—W. D. Collingwood, stone, reported to have given bill of sale for \$1.

Philadelphia, Pa.—James Mann & Co., marble and brownstone, reported to have given judgments for \$5,308.

Findlay, O.—O. C. Altman, stone quarry, reported to have given judgment for \$106.

Eldorado, Kan.—C. M. Sinclair, marble, reported to have recorded chattel mortgage for \$378.

The Alma Portland Cement Company, of Wellston, O., capital stock \$50,000.

St. Louis, Mo.—Abbott Granite Co., has been incorporated by A. F. Abbott, E. D. Anthony, A. L. Berry and J. Weinberg. Capital stock \$10,000.

Newark, N. J.—Mountain View Quarry Co., has been incorporated by Frank B. Allen, James Seme and J. Fleuchaus. Capital stock \$5,000.

Detroit, Mich.—Oehlenbach & Heard, stone dealers at the corner of Fort and Hastings streets, June 9, gave a chattel mortgage to Edward T. Adams, trustee, for \$1,256.38.

Toledo, O.—The New Process Lime Co., reported to have given judgment for \$1,609.

THE HANDY WAGON CO.

Saginaw,
Mich.,

BUILDS A SHORT-TURNING

Stone Wagon

that is constructed on scientific principles. Every fault in old-style wagons overcome. It is essentially *the thing* for hauling stone in close quarters. Built to stand any strain that can be put on it. Easily loaded and unloaded. Traction reduced to minimum. One horse will haul as great a load with it, as two horses can on old-style truck.

**Don't Buy a Wagon
'till You Have
Learned All About
This One.**

Send for illustrated circular
fully describing every feature
of it.

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THE WARDWELL Steam Stone Channeling ^{AND} Quarrying Machine

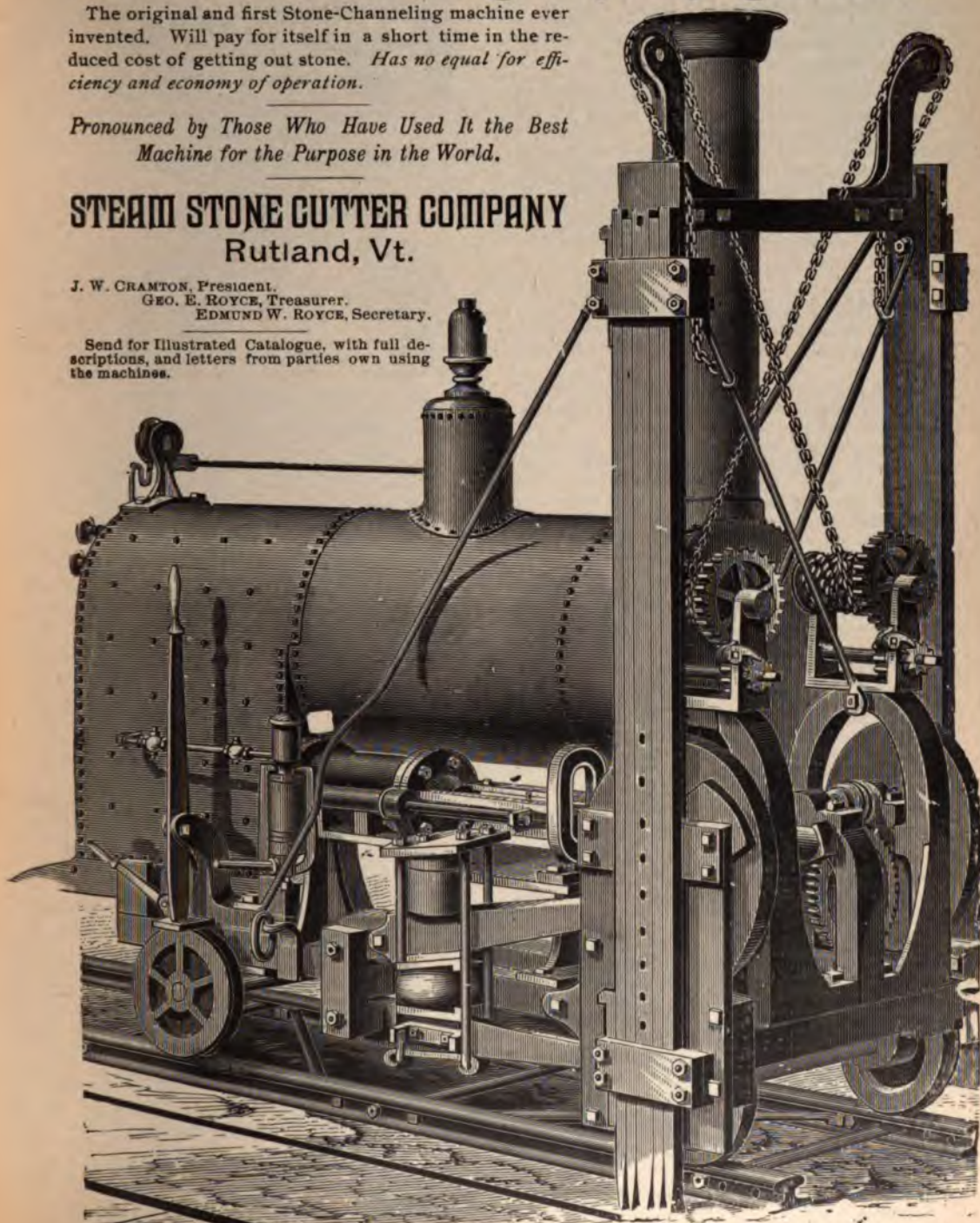
The original and first Stone-Channeling machine ever invented. Will pay for itself in a short time in the reduced cost of getting out stone. *Has no equal for efficiency and economy of operation.*

Pronounced by Those Who Have Used It the Best Machine for the Purpose in the World.

STEAM STONE CUTTER COMPANY
Rutland, Vt.

J. W. CRAMTON, President.
GEO. E. ROYCE, Treasurer.
EDMUND W. ROYCE, Secretary.

Send for Illustrated Catalogue, with full descriptions, and letters from parties own using the machines.



Elmer Coe, the building contractor, has leased the Hodges stone quarry, located six miles northeast of Fort Scott, Kan., and will have exclusive control of it in the future. It was leased from T. W. Hodges, who recently came in possession of it by reason of a suit in district court.

Jack O'Brien, who was injured at the Salem-Bedford mill, Bedford, Ind., in 1892, by having his leg caught in a cogwheel of the traveler, received, \$5,445 from the company June 21—\$4,750 being the amount of the judgment rendered in his favor in November, 1895, and the remainder being interest. One third of the total amount went to O'Brien's attorneys, leaving him \$3,630. The case was in court for several years.

Watertown, N. Y.—Sheriff Kellogg sold June 28 the plant of the Davidson Marble Company, which was bid in by Samuel A. Tolman, of Chicago, the judgment creditor for \$25,000.

Cincinnati, Ohio.—Judge Wright's jury in the \$10,000 damage suit of L. B. Sawyer, administrator of Thomas Brown, against the Covington Stone and Marble Company, returned a verdict of \$2,080, because of the death of intestate, a hod carrier, thrown from the top of the new Elm street school-house by the sudden starting of a hoist. Defense alleged negligence on the part of a fellow employe.

Cromwell, Conn.—Edward Butterworth, one of the well-known and respected citizens of the town, deceased. He was engaged in the stone-cutting business for a number of years, and very successful in all business enterprises.

The Supreme Court has granted a permanent injunction against William T. Le Valley, of Sayville, restraining him from engaging in the marble or granite business within twenty-five miles of Sayville, N. Y. The injunction was granted on the application of Charles U. Danes, who bought out Le Valley some time ago. The suit has been in litigation a long while.

Buffalo, N. Y.—Report says the demand for Orleans County stone is at present so limited that a number of quarries are to be closed down.

Indications point to a speedy termination of the quarrymen's strike at Joliet, Ill. About 350 have formed a union, and a charter has been received from the headquarters of the International Quarrymen's Union. One of the largest quarries there has signed an agreement with the new union for an eight-hour day at \$1.50 per day, and the rest are expected to do so as soon as the union is in working order.

The Portland cement works at Union City, Mich., have been sold to an English syndicate, who will increase the capacity of the works to 1,000 barrels. The price is said to have been \$600,000.



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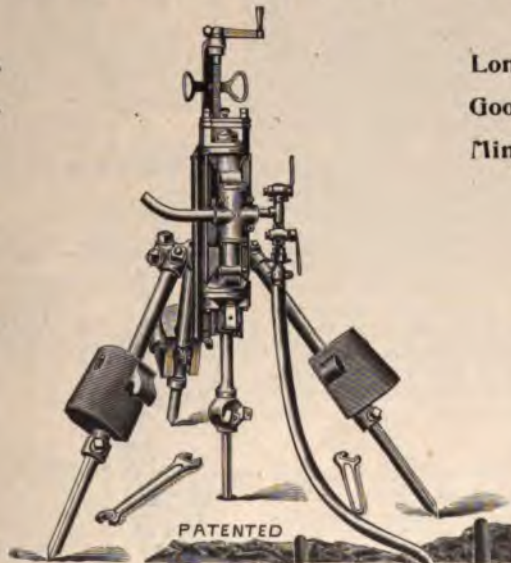
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XV

Helena, Mont.—The state board of land commissioners sold 209 acres of argillite quarry land to Adams and Allen, of New York city, for \$10 per acre. The land is situated about one mile west of Townsend, in section 36, township 7 north, range 1 west. The stone is used by the New York company in making mantels and other stone finishings. There is said to be as much more of the stone on other state lands in that section. The proceeds will go to the public building fund.

N. C. Powelson, of Kingston, N. Y., a contractor, who for months has been engaged in quarrying limestone for the piers of the new East River bridge of Greater New York, has left Kingston, leaving some \$7,000 in unpaid wages to the hundred or more quarrymen and expert stone-cutters employed in his quarries. An attachment has been placed on the machinery at the quarry.

It is predicted that the extensive St. Lawrence marble quarries of Gouverneur, N. Y., idle for a couple of years past, will start up in July. It will mean much to Gouverneur, for the quarries and mill employ about 100 hands at good wages.

As an evidence that the granite business is lively in Barre, Vt., it may be stated that nearly every one of the eighty men thrown out of employment by the burning of the sheds of Mackie, Hussey & Co., recently found employment elsewhere before the day was over, and more than half of them did not lose an hour's time.

P. O. Fletcher, who runs the Excelsior quarry at Graniteville, Vt., and employs ten men, has disappeared, and no word has been heard from him since May 16, when he left his home in Washington to go to his quarry. He got a note discounted for \$214, but did not go to the quarry to pay off his men, says the Newport Standard.

The Machine Stone Workers' Association which was organized by the employers at the time of the lockout of the members of the Machine Stone Workers' Union, recently adopted a resolution that its members form a corporation under the laws of New York to be known as the Machine Stone Workers' Association of New York city. Notices of this meeting have been posted in all the stoneyards in the city. The object is, that in case strikes are ordered against any of its members, suits can be brought in their behalf by the association.

Worcester, Mass.—The Granite Cutters' union has voted to continue the strike at the yard of Evans & Co., where eleven men walked out several weeks ago, because of the firm's refusal to recognize the union's price list. The firm says that they may keep it up till the crack of doom, for they will never be taken back. The men, for their part, are confident of winning.

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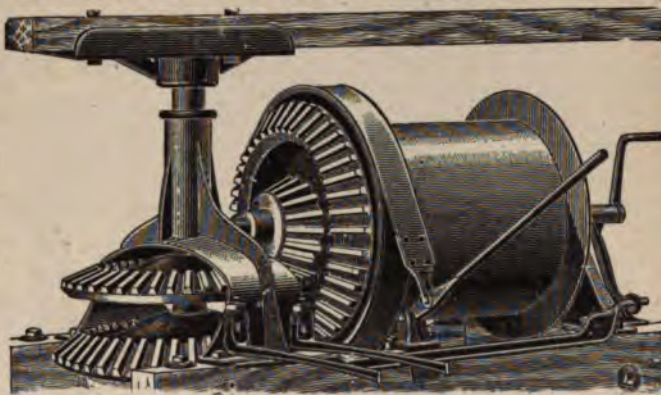
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xvii

Plainville, N. J.—A jointstock company has been formed with a capital of \$50,000 to continue the crushed stone business of White Oak. President, James Cooke; vice-president, John W. Cooke; secretary and treasurer, Irving F. Tinker.

The James G. Crispin Lime and Cement Company, Cincinnati, O., capital stock \$5,000.

Knoxville, Tenn.—The American Marble Company, of Knox county with a capital stock of \$15,000. The incorporators are Harmon Kreis, W. R. Monday, Hu L. McClung and Harry Lyons.

Winnsboro, S. C.—The Leiper-Davis Granite Co., has been incorporated by Amos Davis, George G. Leiper and James O. Davis. Capital stock \$24,000.

W. E. Hughes, Clyde, O., who has recently acquired marble lands near Rockmart, Ga., writes us that he intends to equip a quarry and produce the stock for commercial purposes.

The old granite quarries of Bevan & Son, near Woodstock, Md., are to be reopened for supplying stone for the Baltimore courthouse. About one hundred hands will be given employment.

Kimball Brothers, W. A. and C. J. Kimball, have started marble and granite works at Salem, Mass.

A fine large quarry of blue stone has been opened at Johnsenburg, N. Y., and will give employment to many men.

Salem, N. Y.—Frank B. Hoyt, of Cambridge, is preparing to open a marble shop here.

Cheboygan, Mich., will again have a marble and granite works, the firm being Pennell Bros., from West Branch.

Linn Grove, Ind.—Daniel Yoder is opening a stone quarry on his farm in order to continue the running of his stone crusher.

A deal is closed by which the Clydesdale Stone Co., of Pittsburg, will open a stone quarry in Ellwood City, Pa. A track will be built at once, a number of derricks erected, and employment will be given to quite a number of men. The Clydesdale Stone Co. is one of the most substantial concerns of Pittsburg.

Horton, Kan.—Ruth & Co., marble and granite, succeeded by W. H. Ruth.

Haverhill, Mass.—F. G. Cummings & Co., marble, W. E. Morrill retires.

Montgomery County, Md.—The Antietam Lime & Stone Co., is being formed to operate lime kilns, which will be erected on land recently purchased.

Chariton, Iowa.—Snyder & Enslow, marble, succeeded by D. A. Enslow.

Philadelphia, Pa.—The Philadelphia Big Four Slate Company, to mine slate, was incorporated in New Jersey.

The Illinois and Wisconsin Stone company, Chicago, certified to an increase in capital stock from \$5,000 to \$50,000.



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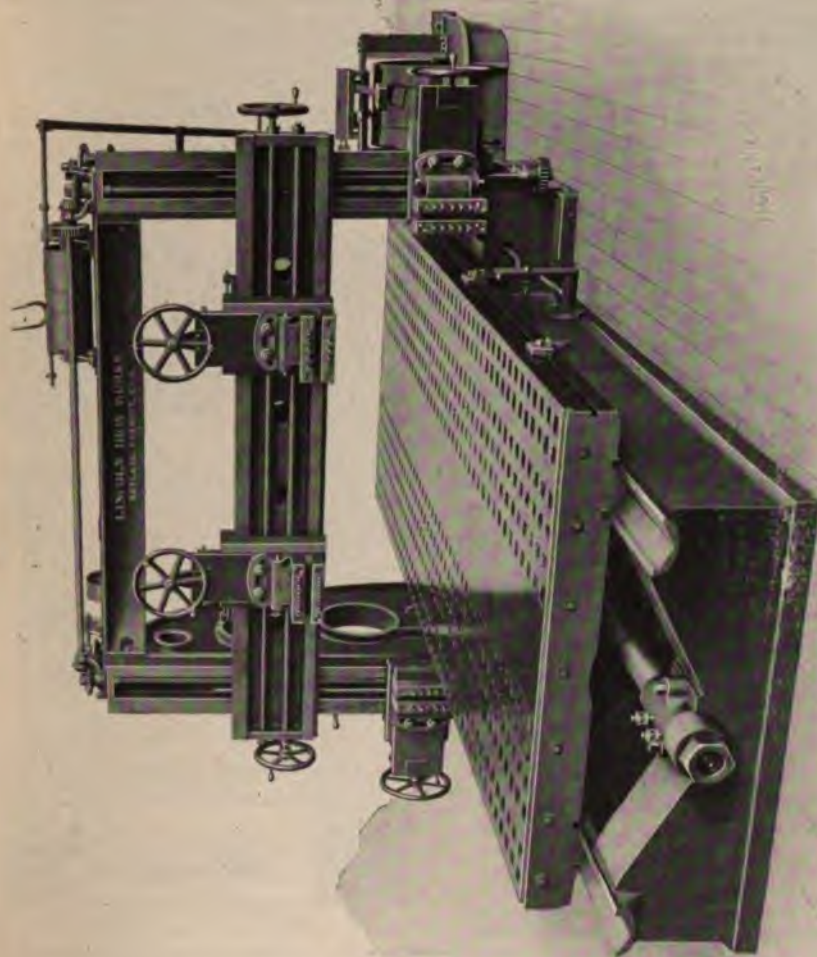
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xix

Chicago.—Although the Stone-Cutters' Association adjusted its differences with the Stone-Cutters' Union, it has failed to bring about the same result with reference to the Hoisting Engineers' Union, as well as that of the sawyers and rubbers, and as a result the two latter organizations, aided by the Building Trades Council have declared war against it. It was the opinion in labor circles when the agreement between the stone-cutters and contractors was reached that the other differences would be adjusted within a day or so, and that the yards would all open. Now all this is changed, none of the machine yards will be opened, and the struggle which has been re-opened promises to be more bitterly contested than was that of the stone-cutters. The engineers demanded $1\frac{1}{2}$ cents more an hour, or $37\frac{1}{2}$ cents, than was paid last year, and an eight-hour day, but the principal trouble seems to have been the refusal of the contractors' association to recognize either the Engineers' or the Sawyers' and Rubbers' Union, or to arbitrate the existing differences. The result was the two unions went before the Trades Council with their grievance, which granted them a committee on stone-yards and on all buildings where stone is used, and union men of all the building trades will be drawn from jobs where stone furnished by the bosses is used.—Tribune, 20th.

Joliet, Ill.—The second stage of the quarry strikes has been reached. The stonemasons and stone-cutters' union decided not to handle stone from any quarries that refused to pay the wages demanded by the strikers.

Jeffersonville, Ind.—The Western Cement Association has gone to pieces. Six mills, known as Haussdale, Eagle, Clark County, United States, Ohio Valley and Sheen's, have withdrawn, being dissatisfied with the allotments. Cement has fallen 5 cents per barrel, and a cut in prices is on.

Kingston, N. Y.—The securing of all attachments at the quarries of the Kingston Limestone Company has been here making investigations with a view of advancing a loan to pay the \$6,000 or more of salaries due, went to New York, together with John F. Cloonan and Henry McNamee representing the workmen, to meet N. C. Powelson and others interested in the company to arrange for Mr. Willoughby to advance the money to pay the men and resume the work.

Chas. W. Goetz died at his home in St. Louis of hemorrhage of the lungs. He was a member of the board of directors of the Carthage Marble and White Lime Works, operating north of Carthage, and was a well known stone quarryman.

New Haven, Conn.—Richard G. Stokes, a well known marble and granite worker and dealer, aged 72 years and 6 months, died after an illness of a few days.

Hawley's Patent Sand Feed

Is used by all the leading firms—saws faster and better than any other sand-feed. More gangs using our feed than any other. Easily kept in order. Also many gangs working satisfactorily, using crushed steel. Can give best of references.

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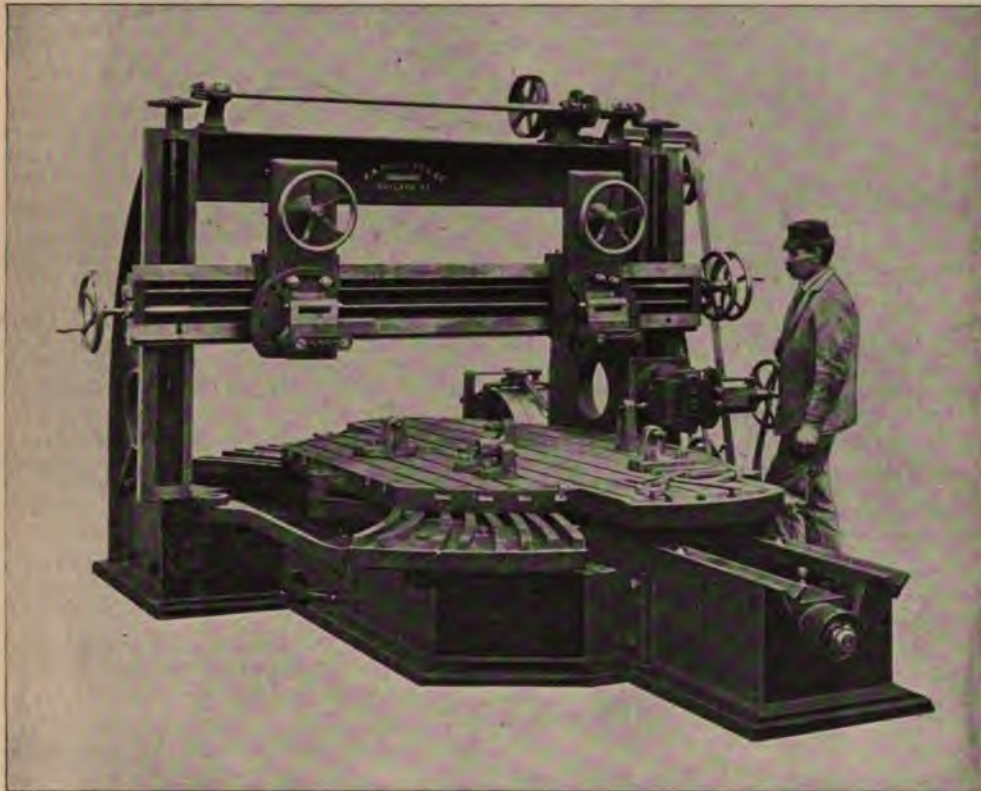
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xx1

CONTRACT NEWS.

Anderson, Ind.—The First M. E. Society will spend \$15,000 in remodeling their church. Dr. Bennett, Pastor.

LeRoy, Ill.—Bids will be received in August for the erection of an \$8,000 church. J. E. Aubrey, Chairman.

Seattle, Wash.—The bill passed the senate appropriating \$500,000 for the construction of a public building at Seattle.

Creston, Iowa.—The Burlington system has decided to build a \$50,000 depot at Creston. J. H. Duggan, Superintendent.

Ottawa, O.—Sealed proposals will be received at the County Auditor's office, Ottawa, O., July 25, 1898, for the materials and labor requisite in the construction and completion of a county jail and sheriff's office, for Putnam County, O. J. C. Jones, County Auditor.

Marengo, Iowa.—The District Court of Iowa County urge the board of supervisors of the county to take immediate steps towards the erection of a jail and jailor's residence suitable for the county needs. M. J. Wade, judge.

Wabash, Ind.—The congregation of St. Bernard's Catholic church has decided to erect a new house of worship, the estimated cost of which is \$20,000. Rev. J. H. Bath, Pastor.

St. Louis, Mo.—The Second Presbyterian Society proposes to build a new church. Geo. H. Schiclos, Geo. W. Anderson and Col. J. G. Butler, Committee.

Peoria, Ill.—It has been decided to rebuild the Great Western Distillery, making it as large as any two distilleries in the world, with a capacity of turning out 95,000 gallons per day. The cost will be over \$500,000.

Davenport, Iowa.—G. A. Hanssen is preparing plans for a church to be erected by the English Luthern Society. The church is to be modern in every way. Estimated cost, \$15,000. Rev. W. H. Blancke, Pastor.

Peoria, Ill.—Westminster Presbyterian Society, owners, Wechselberger & Hewett, architects. Cost, \$15,000. Stone, slate roofs, tile floors.

Painesville, O.—James H. Morley, of Cleveland, has purchased a site and will erect a fine library building which he will present to the city of Painesville.

Manchester, Iowa.—The Congregational Society has decided to build a new church. A. D. Brown, P. E. Trien, committee.

Clinton, Iowa.—The St. John Episcopal Society will build a stone church before winter. Seating capacity 400. Rev. H. H. Morrill, rector.

Columbus, O.—The State Building Commission will receive on or before Saturday, June 25, 1898, plans, specifications and estimates of cost of a building 93x213 feet (approximately), to be the same style of architecture as the present capitol, and of the same height, to be situated about 42 feet east of the present State House, the general plan of which may be seen at the Governor's office. Further particulars furnished on application. A. S. Bushnell, chairman; O. Moore, clerk.

Farmer City, Ill.—M. E. Society, S. A. Bullard, Springfield, Ill., architect. Bids to be received June 30. Cost \$15,000. Brick, stone, slate roof.

Des Moines, Iowa.—A site has been purchased for the erection of a home for the aged. The new association has \$25,000 on hand with which to construct the new building.

Huntington, W. Va.—Proposals will be received July 15 for Home for Incurables. Plans and specifications on file at the office of the architect, Harrison Albright, Charleston, W. Va.

Kankakee, Ill.—Public Library, Morrison & Fuller, Chicago, architects. Contract not let. Cost \$12,000. Two story and basement. Brick, stone, sand stone, stone trimmings, cement work, marble work, slate roof.

Louisville, Ky.—The Main St. Methodist Society has secured funds for the erection of a \$15,000 church. Rev. W. C. Brandon, pastor.

Red Oak, Iowa.—The Montgomery County Board has under consideration the erection of a new jail.

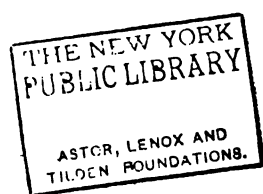
Binghamton, N. Y.—The Binghamton Savings Bank will erect a new building to cost \$50,000. Chas. W. Gennett, cashier.

Sycamore, Ill.—Dr. L. A. Westgate proposes to organize a stock company and build a hospital in Sycamore. Cost is estimated at about \$15,000.

Nashville, Tenn.—The city council June 9 passed a railway terminal bill, and Mayor Dudley will sign it at once. The bill provides that the city will build the approaches to the depot. The structure is to be mostly of marble, and with freight depots, etc., will cost over a million and a half dollars. Work will begin at once. Site is just south of Broad street.

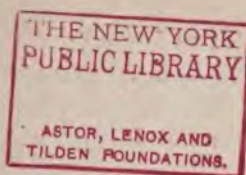
Iowa City, Iowa.—The board of regents instructed the building committee to secure bids for the laying of the foundation of the new college building. Work will begin on the \$175,000 structure at the earliest possible day.

Springfield, Ill.—Ordinances are before the council providing for a city prison.





BRIDGE OF SANT' ANGELO, ROME.



STONE

VOLUME XVII.

AUGUST, 1898.

NUMBER 3.

THE BAYPORT, MICHIGAN, QUARRIES.



THE Bayport quarries, on the line of the Saginaw, Tuscola & Huron railroad, are located upon the northeast quarter of Section 5, in Township 16 north, Range 10 east, in Huron county, Michigan, fifty miles northeast from Saginaw, by the railroad, and about three miles inland from the shore of Wild Fowl Bay, one of the most noted, beautiful and growing health and pleasure resorts in Michigan. This is high but merited praise.

The surface of the quarries is situated forty-eight feet above the level of the bay, and, as at the present time but sixteen feet of the upper layers are worked, this gives ample natural drainage, enabling the quarries to be worked easily and economically.

The upper sixteen feet in the quarries consist of even-bedded, homogeneous, tough, drab-colored limestone, followed by twenty feet of sandstone suitable for grindstones. This is followed by from thirteen to fifteen feet of fine red and brown stone which is underlaid by fifty feet of shale. A space forty by seventy-five feet was quarried to the shale for experimental purposes, and a fine quality of sandstone found. For the purpose of comparing this stone with others STONE tabulated the reports of thirty-two tests of the crushing strength of sandstones, twenty-five of granite, twenty of limestone, and twenty-three of marble. Of the sandstones, samples were from eighteen states, and England and Scotland. Granite from ten states, and Canada, England, Ireland, Scotland and Wales. The limestone came from nine states, beside that from Caen, France, and twenty quarries are represented. The marble is from six states and Italy, and an average of twenty-three tests is given. The authorities for these tests are Gillmore, Haswell, Merrill, Rose Polytechnic Institute, Terre Haute, Ind.; Missouri Geological Report, Johnson, Flagler, Soulè, and Ferris.

The quarry may be divided as follows :

Ledge No. 1. 4 feet thick; used for macadam.

Ledge No. 2. 3 feet thick; burned for lime.

Ledge No. 3. 3 feet thick; building stone.

Ledge No. 4. 3 feet thick; building stone.

No. 1 is a drab, or dove-colored limestone, very hard and tough, used entirely for macadam, for which it is eminently fitted. The ratio of absorption, as determined by Prof. J. B. Johnson, C. E., Washington University, St. Louis, Mo., is one-half to seven-tenths of 1 per cent. Prof. Johnson's conclusions, after an exhaustive study of this quarry, is as follows :

"This is the strongest limestone of which I have any record. It is as strong as the best granite. It is also as impervious to water, that is, as non-absorbent as granite, and will weather perfectly. It is also as heavy as any limestone on record and as heavy as most granites. It is, therefore, an ideal material for all building and structural purposes, as well as for roads and sidewalks. For dressed stone it is rather hard, but for rock-faced masonry it is perfectly adapted. A macadam road constructed of this rock (Ledge No. 1) crushed, properly graded, and well rolled, would make the best possible road for the country, or for the smaller cities and towns; and for cement sidewalks a concrete made up of this rock crushed fine and used with Portland cement, would be as good as the best 'granitoid' walk, in which granite is used."

Nos. 3 and 4 are used for various building purposes. The following analysis, together with the tests relating to the crushing strength of the stone, show its value for macadam, paving blocks for streets, cross walks, curbing, sidewalks, foundations, bridge piers, buildings, etc.:

	<i>Per cent.</i>
Carbonate of lime.....	61.52
Carbonate of magnesia.....	14.50
Sand.....	20.85
Clay.....	2.04
Phosphate of lime.....	.09
Bisulphide of iron.....	.15
Water.....	.85
Total.....	100.00

This analysis shows the stone to be a magnesian dolomite with an addition of a notable amount of sand which gives it an appreciable power to resist the action of the elements, and also the abrasive effects of travel where it is used for streets or sidewalks. The low per cent. of water, which is a measure of its absorptive power, renders it practically frost proof and gives it unusual value for all outdoor uses. It is a very compact, tough, even-grained stone of drab, or dove, color, certain layers of which with age bleach to almost a pure white, resembling marble, but with this advantage over marble, that it is so close-textured that dust, soot, etc., do not adhere



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BAYPORT QUARRIES, CRUSHING PLANT, NO. 1.

to it, but are washed off by rains, leaving a clean, fresh-looking face at all times. Tested both artificially and naturally by freezing processes it resists admirably, showing its high rank as a building stone.

A compression test of this stone was made at the Watertown Arsenal, Massachusetts, number of test being 2,907. The stone tested measured 7.25 inches by 5.93 inches in size, giving sectional area of 42.99 square inches. The thickness of the stone was 2.61 inches. This stone was placed between flat cast-iron platforms and a pressure of 800,000 pounds applied to it for five minutes without injury, except that a small corner cracked off. The load was then released, when a second application of the load of 800,000 pounds was made and continued for five minutes, when the load was again released and the third application of the load was made, which was sustained for five minutes, when the specimen was removed from the machine without apparent injury other than above stated. The specimen was then readjusted with steel plates five inches wide between the compression platforms of the testing machine, so that the compressed surface of the specimen thus tested was 29.65 square inches. A load of 408,000 pounds was applied, when cracking sounds were heard. The load was increased to 460,000 pounds when further cracking sounds were heard, and the load was then increased to 774,000 pounds, being equal to **26,110** pounds per square inch, when the specimen yielded by crumbling and the stone burst into small fragments with a loud report.

This test was made under the supervision of Captain John G. Butler, commanding, and J. E. Howard, engineer. Captain Butler accompanies the report with a letter in which he says :

"The specimen was very hard and I was obliged to send it to a regular stone-cutter to be dressed. You will observe that we could not crush it in its original section. It looks as though you ought to be able to build a tower three miles high without fear of the bottom courses."

The highest crushing strength, shown by the table of sandstones, is 17,725 pounds per square inch; the lowest is 3,000. The average of the thirty-two samples tested is 8,482 pounds, or about one-third that of the Bayport stone.

The highest crushing strength of granite is given by Merrill for the Milford, Conn., stone as 22,610 pounds from 5.93" cube. The lowest is that of Rocklin, Cal., 5,239 pounds from 2" cube.

The average of twenty-five tests is 14,813 pounds, or a little more than one-half of the Bayport limestone. Inasmuch as popular opinion has accredited granite with being the strongest building stone in use, the above figures are rather startling to the average user of stone, but in the cold light of ascertained truth; granite will have to abdicate the throne in favor of the legitimate heir—Bayport limestone.

Compared with other limestones the Bayport stone stands without a peer. STONE has been unable to find any report of any limestone that will bear comparison with Bayport stone in crushing strength. The highest in the list is the Joliet, Ill., limestone, with a crushing strength of 16,900 pounds per square inch; Bardstown, Ky., 16,250; Greensburg, Ind., (Sand Creek quarries), 16,875. The lowest is that of the Austin, Tex., quarries, 3,422, with the English magnesian limestone a close second, having a strength of 3,600. The average of twenty tests is 9,426+ pounds per square inch; a little more than one-third that of the Bayport stone. The proportion between the Joliet and the Bayport stone closely approaches 17 to 26. This means that where the Joliet stone will carry a load of seventeen pounds the Bayport will carry twenty-six. Therefore, a wall built to carry a given weight may safely be built much thinner of the Bayport stone than of any other in the market; even the best granites do not approach it in carrying power. For this reason the Bayport stone demands the attention of architects and builders on the score of economy.

Compared with marble this stone is still an easy victor. The Tuckahoe, N. Y., stone has a crushing strength of 13,594 pounds; the Etowah (Georgia) 13,200; Creole No. 1 (Georgia), average of three tests, according to tests made by Ferris, 13,400; while the California marbles run from 3,730 to 13,190.

Several ledges in this quarry bleach to the whiteness of marble, and, as the stone is not crystalline, it has the added advantage that the surface is perfectly smooth, affording no lodgment to anything that will discolor it. Marble, on the contrary, catches and holds dust, soot, etc., and in a few years fronts made of it have a dirty, grimy appearance, contrasting strongly with the fresh, bright look of the Bayport stone.

This stone is even-grained, tough, even-bedded, coming from the quarry with two faces ready for the laying in the wall; and experience has demonstrated that nearly all stone is stronger and resists the action of the elements better when laid on bed than on edge. Besides, the stratification planes give, as a rule, better mortar beds than stones dressed to a bed, for this reason: the mortar adheres to the opposing faces of the stone better, thus forming a stronger bond of union, while the saving in cost over stone that must be dressed to bed is an important item to the user.

The geological age of the stone in this quarry is, for the lower limestone, probably that of the St. Louis group; that of the upper members, of the Kaskaskia of the sub-carboniferous, or Mississippian terrane.

As a building stone it ranks as A No. 1, as witnessed by the Hoyt Public Library Building, at Saginaw, Mich., and the S., T. & H. R. R. Co.'s office at Saginaw, cuts of which are shown herewith, reproduced from photographs, and, therefore, not exaggerated or changed in any



BAYPORT QUARRIES—THE LIME KILN.

way. Many other fine buildings have been erected of this stone, and it has never failed to satisfy architects, builders and customers.

The stone breaks with what is technically known as a conchoidal fracture, and for this reason is not well adapted to work requiring a smooth surface, but for rock or quarry-faced work it is unsurpassed; also for rubble, foundation, pier, abutment, and other work requiring ability to carry safely heavy loads and to resist the disintegrating effects of the atmosphere. For piers and abutments it is well fitted, for it will resist the abrading effects of streams carrying sand or other material tending to wear the stone, while it will, owing to its great strength and toughness, resist the crushing and grinding effects of floods carrying masses of ice. The above statements will also apply to its use for riprap, breakwaters, etc.

FOR ROAD-MAKING.

For road-making this stone is as well fitted as it is for the purposes enumerated above. The qualities of strength, toughness, resistance to atmospheric agencies render it very valuable for Belgian blocks for street paving, for sidewalks, for street crossings, for cement and vulcanite pavements, for asphalt streets, and for numerous other purposes. On account of its natural cementing properties it is a very superior article for macadam streets and roadways.

Two carloads of Belgian blocks were placed in Tilden street, Saginaw, Mich., at the east end of Johnson street bridge across the Saginaw river, about eight years ago, and STONE recently examined this work and can testify that neither the traffic they have carried nor the elements have had an appreciable effect on them, except to make the top a little smoother than when fresh from the quarry. A material with this record certainly merits the careful investigation of users of this class of stone.

For macadam this stone has been tested and recommended by some of the most eminent engineers and road builders in the country, and it has a growing reputation as attested by the increased sales each year.

The following cities have used this crushed stone for roadways and for foundations for paved streets: Detroit, Grand Rapids, Saginaw, Lansing, Port Huron, Flint, Bay City, as well as many other cities and towns of Michigan and adjoining states.

Bay county, Michigan, has ninety miles of stone road, built under the county system, and is still continuing the good work. Saginaw county, under the subscription system, has built five miles of roads of crushed stone and it is so satisfactory that much more will be built in the near future.

A very important matter to consider in the choice of stone for streets and highways is its resistance to friction, the blows administered by horses when driven at speed, the crushing power of loads, and blows delivered by loads passing over inequalities of surface, and atmospheric action.



HOYT PUBLIC LIBRARY, SAGINAW, MICH.



SAGINAW, TUSCOLA AND HURON RAILWAY CO.'S OFFICE BUILDING, SAGINAW, MICH.

The following table of the usefulness of the various kinds of stone for highways is by Robert Grimshaw, C. E., and was published in Municipal Engineering. In the table average values are given and the conditions of climate, traffic, etc., are the same in all cases. The enormous decrease in durability compared with crushing strength shows the necessity of great care in selecting stone for road-building purposes. This table shows, as experience has demonstrated, that Bayport stone is the best in use for road-making purposes.

Crushing Strength. <i>Lbs. per sq. inch.</i>	Material.	Proportionate Quantity Required.
21,335	Basalt	1
19,912	Basalt	1.08
18,490	Diorite, aphanitic greenstone, augite porphyry, gabbro	1.20
17,068	Granite, syenite, quartz, porphyry	1.32
15,645	Porphyry	1.59
14,223	Millstone grit	1.84
12,801	Graywack	2.15
11,378	Quartz limestone, new red sandstone	2.57
8,534	Jura limestone	4.00
7,112	Jura sandstone	7.00
5,689	Chalky limestone	12.00

BAYPORT LIME.

The Bayport lime is known to the trade as a hot lime and should receive the same treatment as other limes of this class.

Ledge No. 2 is the one used for lime-making, and is used exclusively for this purpose, the demand for which is so great that it requires the working of this ledge in advance of the building ledges, Nos. 3 and 4.

The following analysis by Prof. J. B. Langley, of Pittsburg, Pa., shows it to be an almost pure carbonate of lime:

Silica.....	3.330
Oxide of lime and alumina.....	1.334
Carbonate of magnesia.....	.944
Carbonate of lime.....	91.538
Phosphorus and sulphur.....	Trace
Organic matter and loss	2.854
Total.....	100.000

The high per cent. of lime (nearly 94 per cent.) and the low per cent. of sand, together with the absence of all harmful impurities, give this a high rank among the limes in commercial use.

The kilns, a view of which is shown herewith, are of the most modern type, with all appliances for easily and economically handling the stone and finished product. They are operated under the superintendence of Mr. W. H. Wallace, who has devised many of the labor-saving appliances here used, and he is ably seconded by a corps of experienced employes, both at the kilns and in the quarry.

This lime is used throughout the peninsula of Michigan, and is put on the market both in bulk and barreled. Such care is used in barreling this

lime that it can safely be carried from one season to another if kept in floored sheds. It is highly recommended by architects, dealers, and builders. A long list of names of parties that have used this lime, together with recommendations, might be appended if such were necessary. This lime, like the stone, is its own best advertisement—*once used always desired*.

DISTRICT ASSOCIATIONS.*

THE question of a district or inter-state association is a broad one. It contains many possibilities. Whether or not it may be made profitable, is a matter to be decided by those most interested. The evils which confront us are many. To say that they cannot be overcome is cowardly. That we must meet them is certain, and our success or failure must depend entirely upon the method of attack and the energy employed.

Nothing can be accomplished without concerted effort. A proper system, once adopted and always adhered to, is the secret of every success.

To say that the marble and granite dealers of the West cannot establish and maintain a beneficial organization is to say that they lack intelligence.

The dealer who would discourage an honest effort to place our business upon a higher plane is narrow-minded, and shows a disposition to do business in the dark. The dealer who refuses to identify himself with his home organization is generally actuated by the fear that it will cost something, or that it will restrict him to some other man's way of doing business. He is generally doing a small business, without profit, and should be among the first to embrace an opportunity to better his condition.

The best way to bring this man out is to either lead him to join an association by persuasion or to form an association so strong that he will be afraid to stay out of it; an association so powerful that any attempt to disobey its laws must end in disaster.

Such an association cannot be confined to one state, perhaps, nor to a half dozen states. But, if it requires the membership of every respectable dealer in the land, I believe it can be accomplished.

The fact that a dealer here and there occasionally expresses himself as opposed to certain existing conditions has but little weight in bringing about the desired reforms. Such protests are necessarily fruitless. But a resolution emanating from a regularly organized body of sufficient numbers would be recognized. A combination of the best dealers of the different states could bring about such great reforms that the monumental business would be practically revolutionized.

But we must first organize and then respect our organization. The wholesaler can scarcely be blamed for certain practices when the conduct of

*Paper read by R. H. Prior before the Mass Convention of the Marble and Granite Dealers, held at Council Bluffs, Iowa, July 12 and 13, 1898.

many of his customers lead him to believe that his methods are satisfactory. He needs education as well as many of the retailers. An inter-state association will reach him when all other forms of appeal are unheeded. Such an association should be composed entirely of retailers.

Supposing such an association should acquire a membership of a thousand responsible dealers. This number of men banded together by common interest, working in harmony with a determination to do business in a uniform and honorable manner, would be a power for good. They could dictate the manner in which the guerilla dealer must do business or be forced aside. They could regulate the evils which connect themselves with the question of agents. They could own quarries or establish shops if they thought best.

They could establish a condition of trade as far in advance of that under which we are now laboring as the electric light is in advance of the tallow dip which lights the tent of General Shafter.

If a thousand dealers desired to establish a trade journal that would be conducted solely in their own interests, they could do it and I believe they should. Such a journal could be conducted economically and would prove a vast source of strength to the organization. Its advertising would go a long way toward its support. It would be sent only to members of the association, who would see to it that it did not reach every undertaker in the land.

It would not be the means of educating a lot of "scabs." It would not be placing valuable designs with sizes and prices in the hands of the farmer. It would not be an advertisement, describing a retail stock taken in exchange for advertising. Its editor would not advise customers to buy their work at the quarries. It would keep the best ideas of its supporters constantly before those who are seeking better things.

Such a journal could easily be maintained by an inter-state association, while it would not be practicable for a smaller organization.

A combination of the different state associations would stimulate the growth of each individual organization. A general agreement to maintain certain prices would result in a marked improvement in this direction. The larger the number of dealers who are aiming to accomplish any desired reform, the greater will be the benefits derived. The broader the organization the greater the reform.

Why not, then, get together in a united effort to do away with the evil and promote the good. Get together, work together, enjoy together the benefits that are within our grasp, through an organization that will command the respect of all.

BRIDGE OF SANT' ANGELO.*

THE bridge of Sant' Angelo, was originally called the Pons a Elius, being at the time of its construction the seventh bridge over the Tiber. The river being only about 300 feet wide on the average on this portion. It was constructed under Hadrian, A. D., 138, being opposite the tomb of Hadrian, which is now known as the Castle of Sant' Angelo.

The piers were surmounted by colossal bronze statues and columns, which were destroyed during troubles in Italy. The width of the bridge is 50 feet 9 inches, while the small spans are 26 feet 3 inches, and the large spans 62 feet 4 inches. The statues were replaced by Pope Clement IX. in 1668, by colossal statues of angels on pedestals of white marble, from Bernini's original design. While such decoration is entirely out of place in bridge construction, it does not mar the effect of such a structure in Rome, where everything is of a monumental character, as it might elsewhere.

The molded archivolt, while a somewhat trivial detail for a bridge, really adds to the appearance of arches having such small spans.

CANAL REGIO BRIDGE, VENICE.

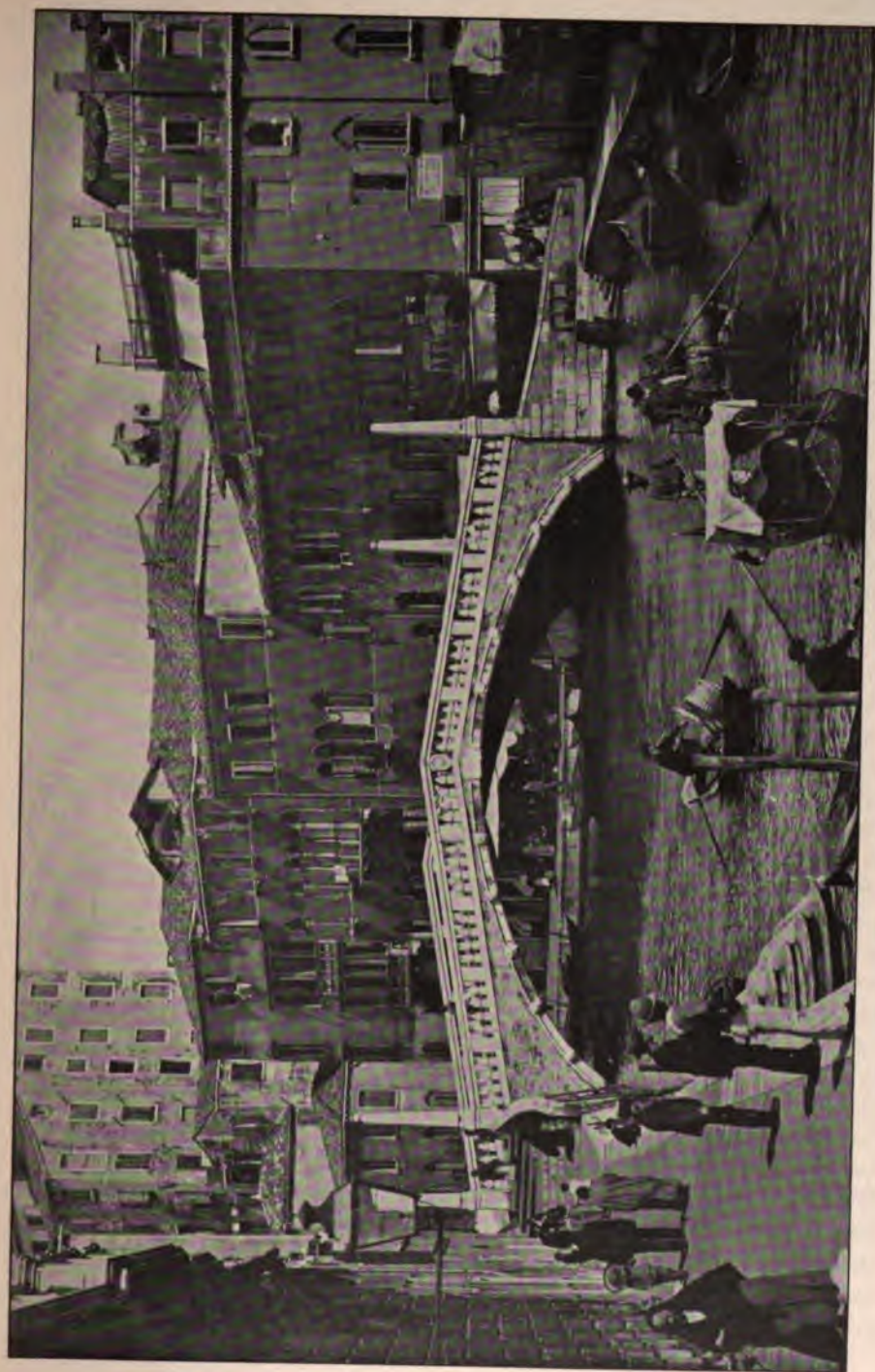
MOST famed of Venetian bridges are those of the Rialto, and that one called the Bridge of Sighs, which has been made famous by Byron's lines:

"I stood in Venice on the Bridge of Sighs,
"A palace and a prison on each hand,
"I saw from out the waves her structures rise,
"As from the stroke of the enchanter's wand."

The bridge of the Rialto, which is so often pictured, was built from the designs of Michael Angelo, and has a single span of 96 feet 10 inches. The bridge effect is somewhat lost by the rows of shops, but the span over the Regio Canal there is nothing to mar the view. The approaches are steep, to give headroom on the canal, and marble steps make the ascent easy. The arch ring is molded, and decorated with heads in relief. The balustrade, with the lofty newels, adds much to its effect.

The bridges of Venice are more a part of the architecture, than of the engineering of the city, and this is, perhaps, a valid excuse for the employment of architectural details in their embellishment.

*Subject of Frontispiece



CANAL REGIO BRIDGE, VENICE.

PRACTICAL STONE-CUTTING.—IX.

EXPLANATION OF THE CONSTRUCTION OF A CARD-BOARD REPRESENTATION OF A SOLID, SHOWING THE DEVELOPMENT AND ACTUAL POSITION OF BED AND JOINT SECTIONS, OF A PIECE OF COPING THE PLAN OF WHICH IS A QUARTER CIRCLE, THE FULL INCLINATION OF THE SECTION PLANE BEING EQUAL OVER THE PLAN TANGENTS.



THE above stated problem is similar to that shown in geometrical elevation at Fig. 3, Plate 5, and is perhaps the least difficult one to be met with in actual practice by the draughtsman. In Fig. 1, B represents the center with which the plan curves may be drawn. A—G, are the points at the center curve at which joints are required. The student having drawn the curves, the joint lines, B—A, B—G, produced, and the tangents to the points A—G, as shown in the diagram in the manner already described for the like operations at preceding examples, will join the intersection B₁ of the tangents with the center B, which will give the directing ordinate of the plan. Then square with this through the center B draw the seat line H—7. Then parallel with B₁—B, through any number of points at the plan curves, including those of A—G, produce lines above the seat line as shown. Now in order to show the section which belongs to the lower joint surface over A, we have to raise the ground plane, in a manner, above that of the seat line H—7; or, as may later be seen, the point A of the joint surface Fig. 2 would meet the ground plane in the point A, so that only that portion, either of the joint or bed section, comprised within 9—1—A, and 1—A—Q would be seen at the model. This important point has been neglected at the models of other authors, the center curve at the cutting plane being the only one shown. No attention whatever has been paid to the projection, either of joint sections, or of the angle made at the intersection of the cutting plane with the surface of the joint, or of a vertical line on its surface. These constructions for the most part are made at the plan, and, as before stated, the operator has to be an expert to understand their connections. At these models, as the operator may readily see, each and every line or mould (with one exception, that of the face moulds, and of course these are not required until the stones may have been brought to their required cylindrical form), required to form the rail or coping are projected, and applied to the actual planes as they would be in practice, leaving no

point to be taken for granted. In order to show the joint surface over A, all that is really necessary will be to raise the ground plane a sufficient height as will enable the joint section to be developed. Here in order to make the construction as clear as possible, we have raised the plane rather higher than is actually necessary. The ground plane is projected in the lines C'—N—A', N₁—A''—8, and C₁₁—C'—i, of Fig. 2, and C—D₁₁, D₁—D, of Fig. 1. The student at his drawing having determined upon the height corresponding with A—A' of Fig. 2, will draw A'—C, indefinitely, and parallel with the seat line. Then setting off at D—G' the assumed height which the coping may rise in going around the curved plan, by joining A' with G' the full inclination of the section plane may be obtained. Then in the manner fully explained for the like operation at previous examples, square over the ordinates, find points, trace the elliptical curves of section, draw tangents, and joint lines at right angles with them, and produce them to meet the inclined line as shown in M—T. Then square G'—A', draw M—H and T—M, meeting the seat line as shown in H—M.

Now to draw the representation of the tangent planes: In Fig. 1 set off A—D, B₁—D₁, B₁₁—D₁₁, and C'—C, equal to A—A', of Fig. 2, and draw D—D₁, and D₁₁—C. Then make D'—E₁₁, D₁₁—E₁₁, D₁—E, and E₁₁—F, equal to N—B', of Fig. 2, and join D—E, E₁—E₁₁, and E₁—F. The height D'—F, if correct, will be equal to the total rise of the coping. Now square with E—D and E₁—F draw D—P and F—H. Notice point H at this drawing, the point at which the tangent line B₁—G, produced, meets the seat line, is also the point at which the line M—H, at right angles with A'—G' meets the seat line. This may not occur at the drawing of the student. In such case follow directions as given at the example which follows at Plate 9.

Now to construct the representation of the joint surfaces: First take that of the lower surface over A. In Fig. 1 draw P—M parallel with the radius B—D. Then in Fig. 2 draw T—M₁₁ parallel with the tangent B''—A'', and with T as center and T—N, T—M as radius cut T—M₁ in N₁—M₁. Join N₁ with A'' and parallel with N₁—A'', draw M₁—Q. Then square with M—Q draw A''—P through A''. This gives in M₁—P produced, the line in which the joint plane meets the plane of the base line H—7.

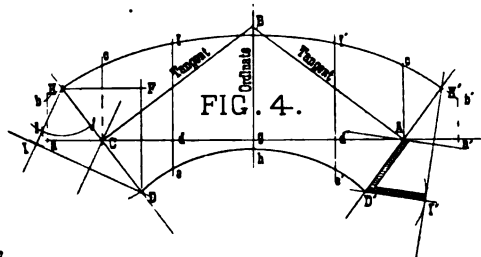
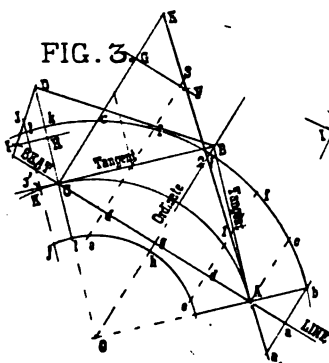
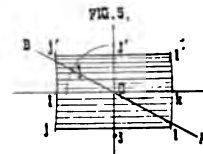
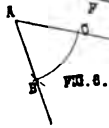
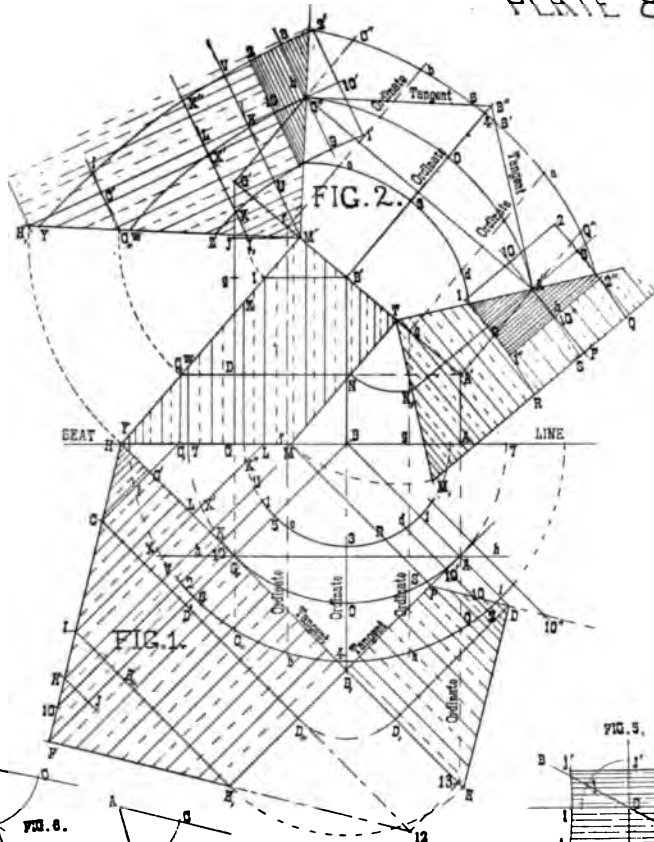
To prove construction: With D—P and P—M of Fig. 1 as radius, and A'' and M₁ of Fig. 2 as the centers, describe arcs meeting in P; lines drawn from A'' and M₁, tangent with the intersection of the arcs, coincide with those drawn by first method, if drawing is correct. A''—P is the line in which the tangent plane over B₁—A intersects the surface of the joint plane.

Now to develope right section: In Fig. 1 set off D—10, equal to the half thickness of the coping, then through 10 parallel with A—B, draw 2—10—10'—d. Then in Fig. 2 produce P—A'', and set off A''—10'',

equal to the half thickness of coping and parallel with N_1-A'' produced draw $1''-10''-2''$, equal with $2-10'-d$ of Fig. 1. Then make $9-A''-8$, and $R-S-P-Q$, equal to $D-A-1$, and $R-S-P-Q$ of Fig. 1. Through the points given in $1-9-1''-R$, and $2-8-2''-Q$, trace curves and the contour of right section may be obtained. To draw the representation of joint surface over G : Through M parallel with tangents $B''-G''$ of Fig. 2, produce $M-H$. With M as center and $M-I$, $M-C_1$, $M-H$ as radius, cut $M-H$ as shown in $I_1-C_{11}-H_1$; join H_1 with G'' . This gives the line in which the tangent plane over B_1-G , meets the surface of the joint, and if correct equals the length of $F-H$ of Fig. 1. Then square with $G''-H_1$, through $M-I_1-C_{11}$ draw $M-K$, I_1-L , $C_{11}-C'$; these give the position of level lines at the surface of the joint, and whose horizontal traces are given in $V-K-U-M$, $X-X'-X''$ and $C'-C_{11}$ of the plan. On an inspection of the drawing the reader will see the method of finding the curves of right section are similar to that explained for the like operation at the lower surface, so that a detailed explanation is unnecessary. Now take a sharp knife cut clear through the board at the outline of the drawing; at section plane follow outline of tangents at $6-B''-6'$. Then at the lines $2'-M$, $M-T$, $T-2''$, and $H-M$ of Fig. 2, and at $H-B_1$, B_1-P of Fig. 1, cut about half through the board. Then fold the three sides of the solid into position as before explained with lines on the exterior. Then fold over the section planes into their position, which will complete the model. Then as directed at preceding models, cut a set of joint and bed sections to full size, and make use of them as there directed. In Figs. 3-4 are shown the method by means of which the bed mould may be developed in practice. The plan Fig. 3 may be drawn as directed above. Then join $A-C$ with the chord line $C-g-A$. This is the seat line, and if drawing is correct will be at right angles with $O-B$. Square with $A-C$, draw $C-E$ equal to the total rise of coping, joining E with A , gives the full inclination of section plane. Then produce the joint line $O-C$, and set off $C-D$, equal to the half rise of coping, and joining D with B , the inclination over tangent $B-C$ may be obtained. Now in Fig. 4 draw any line as $a-a'$, and on it set off $a-C-d$, etc., equal to like divisions of $a-A-1$, etc., of Fig. 3, at each point square over lines as shown, and make them equal in length to that of the corresponding ordinates of plan. Trace first the convex curve $b-f-f'-E'-b'$; then set off $A-D'$, equal with $E'-A$, and points are given in $D'-D$, at which to trace the concave curve.

To develop joint section: Parallel with $C-A$ through E draw $E-F$; then square with $A-C$, through D draw $D-F$. At Fig. 3 set off $E-F$, equal to $E-F$ of Fig. 4. Parallel with $A-C$ draw $F-G$. This gives in $G-E$ the vertical height of E of Fig. 4, above that of D at the upper joint, and that of D above E at the lower joint surface. Understanding this set off in Fig. 3, $D-H$

PLATE 8.



equal to E—G, and draw H—I parallel with B—C; then with D—I as radius, and E of Fig. 4 as center, draw an arc at I. Repeat the operation with D' of the lower joint as center. Then tangent with the arc, draw D—I and E'—I'. Or make D—I, E'—I', equal the width of coping as given in k—l of the plan, and joining E—I, and D'—I', the position of the plumb line at the joint surface may be obtained. Now transfer the angle D—I—E to Fig. 5. The method by means of which this may be done is shown in Figs. 6—7. Let it be required to transfer to Fig. 7, the angle C—A—B of Fig. 6. In Fig. 7 draw any line as A—C, then with A of Figs. 6—7 as centers, and any radius draw arcs as shown. Then make C—B Fig. 7, equal C—B of Fig. 6, join A—B and the required angle may be obtained. Having transferred the angle D—I—E to Fig. 5, set off C—J, equal to the half thickness of the coping, draw j'—J'—i', square with J'—J. Then at Fig. 3 make D—J equal to the half thickness of coping and through J draw J—i—J'—j, parallel with O—C. Then at Fig. 5 make j'—J'—i', and l—C—k, equal to i—J'—j, and k—C—l of Fig. 3, and through the points i—k—i', etc., trace the contour of the section. At all times set off the distances given between the point as J' at the tangent, and the points i—j at the plan curves in developing the joint sections. *Charles H. Fox.*

PUEBLO ARCHITECTURE.*

TO understand the ruins so profusely scattered over the ancient pueblo country we must have some knowledge of the condition under which their inhabitants lived. Were nothing at all known, however, we would be justified in inferring, from the results that have been produced, a similarity of conditions with those prevailing among the pueblo tribes, both formerly and now; and all the evidence so far obtained would support that inference. There is no warrant whatever for the old assumption that the "cliff dwellers" were a separate race, and the cliff dwellings must be regarded as only a phase of pueblo architecture.

More or less speculation regarding the origin of pueblo culture is the usual and perhaps proper accompaniment of nearly all treatises bearing on that subject. Early writers on the Aztec culture, aided by a vague tradition of that tribe that they came from the north, pushed the point of emigration farther and farther and still further north, until finally the pueblo country was reached. Pueblo ruins are even now known locally as "Aztec ruins." Logically the inhabited villages should be classed as "Aztec colonies," and such classification was not unusual when the country came into the possession of the United States some fifty years ago.

As our knowledge of the pueblo culture increased, a gradual separation

*Cosmos Mindeleff in 16th Annual Report of the Bureau of American Ethnology.

between the old and the new took place, and we have as an intermediate hypothesis many "Aztec ruins," but no "Aztec colonies." Finally, as a result of still further knowledge, the ruins and the inhabited pueblos are again brought together; several lines of investigation have combined to show the continuity of the old and the present culture, and the connection may be considered well established. But there is still a disposition to regard the cliff ruins as a thing apart. The old idea of a separate race of cliff dwellers now finds little credence, but the cliff ruins are almost universally explained as the results of extraordinary, primitive, or unusual causes.

The intimate relation between the savage and his physical environment has already been alluded to. Nature, or that part of nature which we term physical environment, enters into and becomes part of the life of the savage in a way and to an extent we can hardly conceive. A change of physical environment does not produce an immediate change in the man or in his arts, but in time such must inevitably result. Twenty-five years ago the savage of the plains and the savage of the pueblo country were regarded as distinct races, "as different from each other as light is from darkness;" yet the differences which appear so striking at first have become fewer and fewer as our knowledge of the Indian tribes increased, and those which remain to-day can almost all be attributed to a difference in physical environment.

Linguistic researches have shown the close connection which exists between the Hopi (Moki) and some of the plains (or so-called "wild") Indians. There is no doubt that at the time of the Spanish discovery, some three hundred and fifty years ago, the Hopi were quite as far advanced as the other pueblo tribes, and the conclusion is irresistible that since it may reasonably be inferred that one tribe has made the change from a nomadic to a sedentary life, other tribes also may have done so. We may go even further than this, and assume that a nomadic tribe driven into the pueblo country, or drifting into it, would remain as before under the direct influence of its physical environment, although the environment would be a new one. Granting this, and the element of time, and we will have no difficulty with the origin of pueblo architecture.

The complete adaptation of pueblo architecture to the country in which it is found has been commented on. Ordinarily such adaptation would imply two things—origin within the country, and a long period of time for development—but there are several factors that must be taken into consideration. If the architecture did not originate in the country where it is found it would almost certainly bear traces of former conditions. Such survivals are common in all arts, and instances of it are so common in architecture that no examples need be cited. Only one of these survivals

has been found in pueblo architecture, but that one is very instructive; it is the presence of circular chambers in groups of rectangular rooms, which occur in certain regions. These chambers are called *estufas* or *kivas*, and are the council houses and temples of the people, in which the governmental and religious affairs of the tribe are transacted. It is owing to their religious connection that the form has been preserved to the present day, carrying with it the record of the time when the people lived in round chambers or huts.

In opposition to the hypothesis of local origin it might be stated that there is no evidence of forms intermediate in development. The oldest remains of pueblo architecture known are but little different from recent examples. But it must be borne in mind that pueblo architecture is of a very low order, so low that it hardly comes within a definition of architecture as an art, as opposed to a craft. Except for a few examples, it was strictly utilitarian in character; the savage had certain needs to supply, and he supplied them in the easiest and most direct manner and with material immediately at hand. The whole pueblo country is covered with the remains of single rooms and groups of rooms, put up to meet some immediate necessity. Some of these may have been built centuries ago, some are only a few years or a few months old, yet the structures do not differ from one another; nor, on the other hand, does the similarity imply that the builder of the oldest example knew less or more than his descendant to-day—both utilized the material at hand and each accomplished his purpose in the easiest way. In both cases the result is so rude that no sound inference of sequence can be drawn from the study of individual examples, but in the study of large aggregations of rooms we find some clues.

The aggregation of many single rooms into one great structure was produced by causes which have been discussed. It must not be forgotten that the unit of pueblo construction is the single room, even in the large, many-storied villages. This unit is often quite as rude in modern work as in ancient, and both modern and ancient examples are very close to the result which would be produced by any Indian tribe who came into the country and were left free to work out their own ideas. Starting with this unit the whole system of pueblo architecture is a natural product of the country in which it is found, and the conditions of life known to have affected the people by whom it was practiced.

Granting the local origin of pueblo architecture it would appear at first sight that a very long period of time must have elapsed between the erection of the first rude rooms and the building of many-storied pueblos, yet the evidence now available—that derived from the ruins themselves, documentary evidence, and traditions—all suggest that such was not necessarily the case. As a record of events, or rather of a sequence of events, tradi-

tions, when unsupported, has practically no value; but as a picture of life and of the conditions under which a people lived it is very instructive and full of suggestions, which, when followed out, often lead to the uncovering of valuable evidence. The traditions of the pueblo tribes record a great number of movements or migration from place to place, the statements being more or less obscured by mythologic details and accounts of magic or miraculous occurrences. When numbers of such movements are recorded, it is safe to infer that the conditions dictating the occupancy of sites were unstable, or even that the tribes were in a state of slow migration. When this inference is supported by other evidence, it becomes much stronger, and when the supporting evidence becomes more abundant, with no discordant elements, the statement may be accepted as proved until disproved.

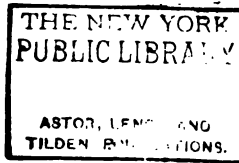
The evident inferiority of the modern pueblos to some of the old ruins has been urged as an argument against their connection. While degeneration in culture is yet to be proved, degeneration of some particular art under adverse conditions, such as war, continued famine or pestilence, is not an uncommon incident in history, and it can be shown that under the peculiar conditions which prevailed in the pueblo country such degeneration would naturally take place. One of the peculiarities of pueblo architecture is that its results were obtained always by the employment of the material immediately at hand. In the whole pueblo region no instance is known where the material (other than timber) was transported to any distance; on the contrary, it was usually obtained within a few feet of the site where it was used. Hence, it comes about that difference in character of masonry is often only a difference in material. Starting with a tribe or several tribes of plains Indians, who came into the pueblo country, we should probably see them at first building houses such as they were accustomed to build—round huts of skin or brush, perhaps partly covered with earth, such as were found all over middle and eastern United States. Supposing the tribe to have been not very warlike in character and subsisting principally by horticulture, these settlements would necessarily be confined to the vicinity of springs and to little valleys where the crops could be grown. The general character of the country is arid in the extreme, and only in favored spots is horticulture possible. In a very short time these people would be forced to the use of stone for buildings, for the whole country is covered with tabular sandstone, often broken up into blocks and flakes ready for immediate use without any preparation whatever. Timber and brush could be procured only with difficulty, and often had to be carried great distances.

It has been suggested that the rectangular form of rooms might have been developed from the circular form by the crowding together upon restricted sites of many circular chambers; but such a supposition seems unnecessary. A structure of masonry designed to be roofed would naturally

be rectangular; in fact, the placing of a flat roof upon a circular chamber was a problem whose solution was beyond the ability of these people as has already been shown. Along with this advance, or perhaps preceding it, the social organization of the tribe, or its division into clans and phratries, would manifest itself, and those who "belong together" would build together. This requirement was a very common one and was closely adhered to even a few years ago.

Although degeneration in arts is common enough, a peculiar condition prevailed in the pueblo region. So far as the architecture was concerned war and a hostile human environment produced not degeneration but development. This came about partly because of the peculiarities of the country and partly through the methods of war. The term war is rather a misnomer in this connection, as it does not express the idea. The result was not brought about by armed bodies of men animated by hostile intentions or bent on extermination, although forays of this kind are too common in later pueblo history, but rather by predatory bands, bent on robbery and not indisposed to incidental killing. The pueblos, with their fixed habitations and their stores of food, were the natural prey of such bands, and they suffered, just as did, at a later period, the Mexican settlements on the Rio Grande, with their immense flocks of sheep. It was constant annoyance and danger, rather than war and pitched battles.

The pueblo country is exceptionally rich in building material suited to the knowledge and capacity of the pueblo builders. Had suitable material been less abundant, military knowledge would have developed and defensive structures would have been erected; but as such material could be obtained everywhere, and there was no lack of sites, almost if not quite equal to those occupied at any given time, the easiest and most natural thing to do was to move. Owing to the nature of the hostile pressure, such movements were generally gradual, not en masse; although there is no doubt that movements of the latter kind have sometimes taken place.



FAN VAULTS.*



THE general construction of fan vaults may be understood from the sections. These represent one of the most complete, which covers a kind of chapel at the east end of Peterboro Cathedral. The workmanship of this vault is the most perfect of any that I have examined. The span of King's College Chapel (42 feet) is much greater, but its workmanship is not nearly so good. The span of the Peterboro vault is 26 feet from wall to wall.

The pattern of these vaults is always a kind of tracery of the same class as the perpendicular tracery which at that period occupied the heads of windows or the surfaces of the walls, the only difference being that the mullions, instead of being parallel and vertical, are curved and radiate from an impost. Instead, therefore, of the horizontal transoms of windows, we have level circles intersecting the ribs at nearly equal distances, and intermediate rays or ribs are inserted between the principal ones. The panel spaces into which the surface of the vault is thus divided are furnished with arch heads and foliation, exactly as the similarly produced panels are ornamented in tracery of windows.

In the lierne vaults a star pattern is commonly found, which radiates from each impost in the same way as the fans of the present class of vaults. The difference between the star and the fan is that the star is formed of ribs, which may be and often are of different curvature, and the rays of the star of different length, but so skillfully arranged with regard to their solid effect, that although irregular upon the plan, this irregularity is not offensively perceived in the complete work.

The fan is, on the other hand, formed of ribs strictly of the same curvature and elevation, and its outline is bounded by a horizontal circular rib instead of the zigzag line of liernes in the former vaults by which the rays of the star are pointed. The effect of the fan is that of a solid of revolution upon whose surface panels are sunk; the effect of the star is that of a group of branching ribs. This difference of character is assisted by the mode in which the mouldings are disposed in two cases. In the older vaults a vertical plane upon the plan line of every lierne or rib divides it into two symmetrical halves; but in the fan vaults the moulded rings and

*Professor Willis on the "Construction of the Vaults of the Middle Ages," published in the Transactions of the Royal Institute of British Architects.

arch heads are all perpendicular to the surface of the vault. This will be more fully explained presently.

In fan vaults the quantity of decoration is so much increased and its parts become so small that it is no longer practicable to frame the tracery of these vaults on the rib and panel system with liernes and boss stones,

FIG. 1.

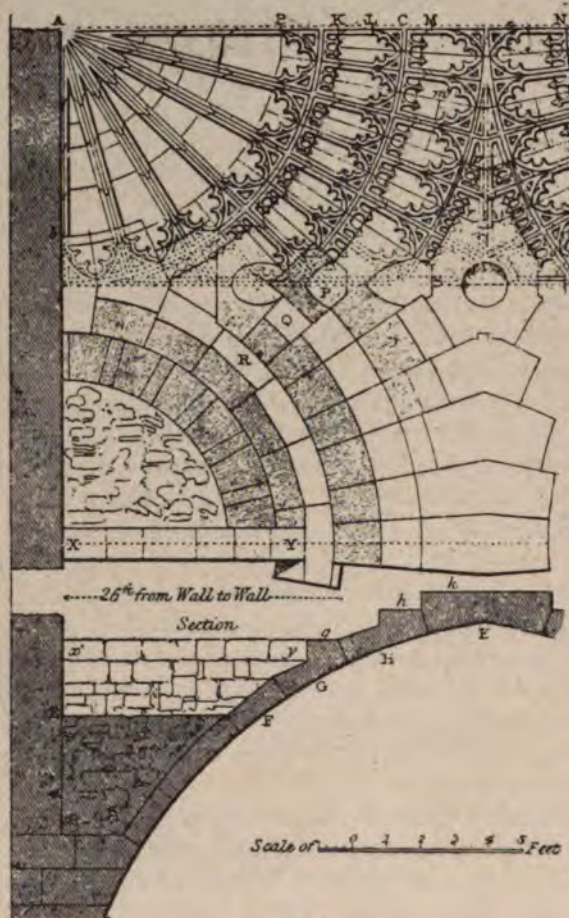


FIG. 2.

c, consisting of plain ribs only, is constructed of rib and panel-work exactly like the older vaults; but all the remainder is of jointed stone work, as shown in the lower plan.

The section shows that the spandrels of this vault are filled up to the level of E with rubble-work. In addition to this, a wall, x y is added to stiffen the spandrel. This I have not seen elsewhere. Everyone of the

and consequently the portions near the crown of the vault, where the decoration is compressed and crowded, are always constructed of joint masonry. But the branching ribs below the first series of arch heads are still built of long stones filled in with panels and the *tas de charge* from whence the ribs spring is also laid in level courses as before.

In Fig. 1 the upper half of the plan represents the lower surface of the vault with the joints of the masonry and pattern of the tracery, and the lower half shows the upper surface of the vault with its joints. Fig. 2 is a vertical section through A c, and Fig. 3 an isometrical projection of the upper surface. The portion of vault included within the spandrel A B

stones of the jointed masonry retains a portion of the horizontal surface of operation, which in this construction is evidently employed for the same purpose as in the boss stones of the lierne vaults. These horizontal surfaces are indicated upon the plan by the light tint, and are also shown in the section at *g*, *h* and *k*, and more clearly in the perspective drawing, Fig. 3.

The joints of the masonry are evidently arranged with reference to the pattern of the vault. Thus a ring of stones round *A*, beginning at *в κ*, is made to contain all the first series of panel heads, with the circular rib and crown of Tudor flowers. The succeeding ring from *κ M* contains the next series of panels, with their arch heads and the Tudor flowers above them. As to the next ring, it begins at *M N* by extending across the crown of the arch, and when the stones become too large they are divided, as at *m n*, *p q*

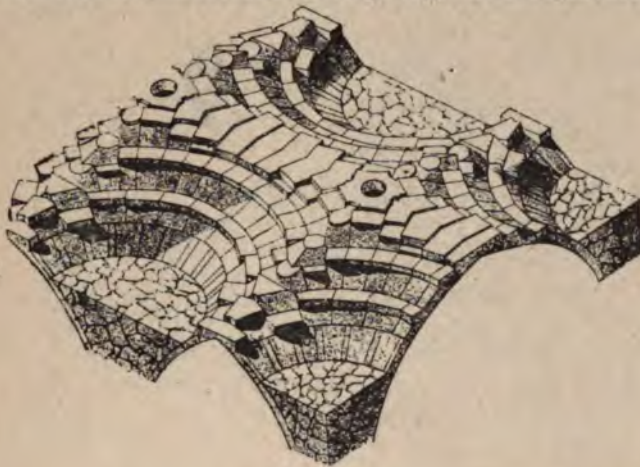


FIG. 4.

and *r s* in such a manner as to interfere as little as possible with the lines of the pattern. It is remarkable that the masons of this period often place a joint in the very middle of a projecting rib, as at *p q*. As to the radiating joints they lie in this example in the middle of the panels, but in others not universally so. Since the disposition of the joints is thus governed entirely by the pattern of the tracery, it is clear that in setting out the moulds of the stones the lower joints must first have been drawn upon the plan, and then the moulds of the upper surfaces obtained from them by a system of projection similar to that which I have already applied to the lierne vaults bosses.

It must be supposed that the lower surface of the stones was worked smooth, and the lesser ornamental details drawn upon this surface, so that for the purpose of settling the places of the joints only the ribs and circu-

lar bands were drawn on the plan, for if the entire pattern were drawn on the plan and transferred to the surface of the vault by projection, as in the case of the complex lierne vaults, the arch heads, circular panels and other figures which decorate the spaces between the principal lines would be distorted. So that we may assume that these details were traced upon the lower surface of the vault stones, but that all the principal lines necessary for obtaining the form of the stones and distribution of the joints were projected from the plan. Indeed, the new manner in which the mouldings are worked, namely, perpendicular to the surface of the vault, as already mentioned, shows that the patterns were now drawn upon and sunk into that surface, and not derived from the plan.

I will now explain the steps by which I suppose the shapes and moulds of the stones to have been obtained, and which in principle is the same as

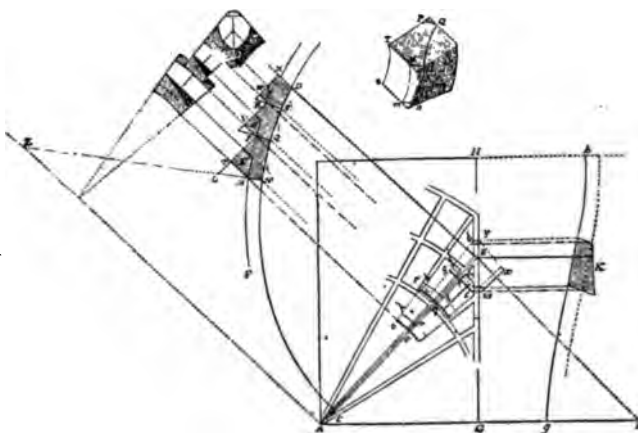


FIG. 3.

the method by which I have obtained the boss stones and liernes, namely, by means of the horizontal upper surface of operation, of which there is abundant evidence to prove the employment in all the existing specimens of fan-vaulting of which the upper surface is accessible.

Fig. 4 explains this method, and corresponds in the plan of the vault to Fig. 1, the examples chosen being the stone marked *p* and those which correspond to *q* and *r* on the opposite side of the ridge rib.

On the plan Fig. 4, the ribs and circular bands being inserted, as shown by the double lines, draw *A B* the central line of the rib upon which the stones in question lie, and upon it draw in elevation *c D*, the curve of the rib, which, from the nature of fan-vaulting, is the same for every rib.

The joints at the lower surface must next be drawn upon the plan, as shown by the dotted lines, due regard being had to the ornamental details

which are to be subsequently added. These joints are either radial or circular, from the nature of fan-vaulting. The radial joints which converge to the center *A* are all in vertical planes, and therefore their places upon the upper plan or surface of operation will be vertically above and coincident with their places upon the lower surface, as at *ab* and *cd*. But the circular joints are arch beds,* and their places upon the upper surface may be obtained from those of the lower surface by upwards and downwards projection as follows.

The circular joints intersect the line *AB* at the points *n, q, s*. Project these upwards to meet the curve *CD* at *N, Q, S*. Draw *FMX* concentric to the curve, and at a distance from it equal to the necessary thickness of the rib *CD*.

From the center of curvature of *CD* draw the arch joints *NM, QP, SR*, intersecting their outer curve at *M, P, and R*; and through these points draw vertical lines *MT, PV, RW*, also projecting the same points downwards to the plan at *m, p* and *r*. With center *A* draw circular arcs *am, cp, gr*. Thus will be obtained the plans or moulds of the upper level surface of operation of the stones *NP, QR*, and the horizontal lines *TPVR* will be the sections of these upper surfaces.

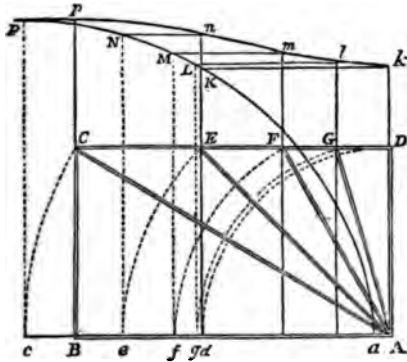


FIG. 5.

To complete the third stone *sx*, however, it is necessary to draw the curve of the ridge rib, for this stone, being placed at the meeting of two

ribs *ABFB*, and of the ridge *GBH*, resembles in this respect a boss. It is in fact upon the plan a six-sided figure, bounded by four arch joints, *gt, tw, wx, dy*, and two radial joints *gd, yx*.† The joint *wx* being opposite and similar to *gt*, the same section *wsxd* will serve for the two joints, but the joints *tw, dy*, must be obtained from the elevation of the ridge rib, which may be drawn as follows:

Since the arc ribs of a fan vault are all of the same curvature, the ridge ribs can no longer be horizontal, and their form is, in fact, determined

*These beds are in fact conical surfaces, which may be obtained theoretically. Draw *Az* perpendicular to *AB*, then will *Az* be the axis of the solid of revolution or spandrel conoid generated by the curve *CD*; and *mn* being any given arch joint of this solid, produce it to meet the axis in *z*. The bed of which *mn* is a section is a frustum of the cone that would be generated by the revolution of *zn* round the axis *Az*.

†Sometimes, when the pattern of the vault admits of it, one or both of the ridge joints *dytw* are omitted, and the stone brought to a point on the plan at *tw* or *dy*. This happens to be the case in the stone which at Peterboro corresponds to the one I am now describing, as will be seen in Fig. 1; but as the two joints in question are very often employed I have inserted them in this place to make the description of the method complete.

by the intersections of the arch ribs, so that when the dimensions of the parallelogram which is to be covered by each severity of the vault, and also the curves of the rib are given, the form of the ridge rib may be found. For example, as follows: Let $A B C D$ (Fig 5) be one-quarter of the severity, $A D, A G, A F, A E, A C$ the ribs branching from A , of which $a k n p$ is the curve in elevation upon $A B$. $A c$ is made equal to the longest rib, namely, the diagonal rib, $A C$; and the lengths of the other ribs are transferred by arcs of circles round the center A to the points $d g f e$ respectively. Draw perpendiculars upon these points meeting the curve in $k l m n$ and p , then will G be the plan of the point at which the rib $A G$ intersects the ridge rib, and $A g$ is equal to $A G$, consequently $a l$ is the portion of arch curve occupied by the rib $A G$, whence $g l$ is the height of the ridge rib at G above the impost plane. In like manner $A c$ (equal to $A E$) shows $a n$ to be the quantity of arch curve occupied by the rib $A E$, and thence $e n$ is the height of the ridge rib at E . Similarly it can be shown that $d k, g l, f m, e n, c p$ are the respective heights of the points $D G, F E C$ of the ridge rib. Draw, therefore, perpendiculars $D k, G l, F m, E n, C p$ through these latter points, producing them to $A B$, and also parallel lines $k k, l l, m m, n n, p p$, intersecting them in k, l, m, n and p , then will the curve drawn through these points to the elevation of the ridge rib correspond to $A B$.

The curve so obtained being transferred to the plan Fig. 4 at $g h$, the section of the stone in the middle plane of the ridge rib may be drawn, as at k , by upwards and downwards projection, in the same manner as the other sections have been obtained.

The stone $N P$ may now be worked as follows. Having leveled the upper surface of operation, trace upon it the upper mould which has been described upon the plan at $m a c p$ and also the arc $b q$. Work the radial joints perpendicular to this surface and trace upon them the side mould $N M T P Q$. Work a concave surface also perpendicular to the surface of operation, and meeting it in the line $a m$ and a convex surface meeting it in the line $b q$. Fig. 4 *a* represents the stone in the state to which it has now been brought. It is viewed angularly. $t T P$ is the edge of the surface of operation, $N M T P Q$ one of the radial sides plane and perpendicular to the latter surface, and $t t m m$ is the concave surface, also perpendicular to the upper surface. The outline of the side mould is shown traced upon the radial surface. To complete the stone it remains to form the two conical arch beds $m m n n$ and $P Q$. The latter is easily wrought by tracing a horizontal line on the convex surface, beginning at Q , and then working away the stone in straight lines from this line to the arc already traced on the upper bed from P , or this bed may be worked by means of a bevel set to the angle $t P Q$, and thus the necessity for working the convex surface be dispensed with.

In like manner the lower arch bed $m m n n$ may be wrought in two ways;

first, by tracing from *m* the horizontal line *m m* on the concave surface and working the bed by a bevel set to the angle *τ m n*; secondly, by working the lower surface of the stone into a horizontal plane passing through *n* and parallel to the upper surface, tracing the arc *n n* upon the lower plane and then working away the stone in straight lines from *m m n n*. The bevel method being the simplest is most probably the one which was employed by the Middle Age workmen. The other method is more analogous to modern practice and is susceptible of greater precision. The two arch beds being completed, the lower surface *n n q* is easily wrought from the lower boundary *n n* to the upper boundary which passes through *q* by means of a sweep or templet whose edge is cut to the curve *n q*.

A similar process will give the form of the more complex stone at the intersection *b* of the ribs.

In forming the boss, the stones were worked to an acute angle, by which means a superfluous angular lump of stone is left. If the upper plan of the stone had been projected as in the above method from the point where the arch joint meets the outer curve of the rib, the useless portion would have been saved and a smaller stone have served the purpose. This is a more complete and scientific process, and while the angle remaining in the Canterbury bosses and others is evidence of the ruder process, the vertical surfaces *τ m m t* (Fig. 4 *a*), which may still be traced in the fan vaults, prove also the use of the improved method which I have just explained. In the later lierne vaults, however, this latter method is also applied to the bosses. In fact the fan vaulting was invented long after the lierne vaulting, but they continued to be practiced together up to the latest period, and the improved system of stone cutting introduced by the increased complexity of the fan vaults would naturally be applied to the lierne vaults. Thus it happens that many of the later specimens of the latter are constructed with solid masonry instead of the original rib and panel method. In the view of the roof of St George's Chapel it will be seen that the bosses were worked vertically downwards from the plan in the same manner as the stones in Fig. 4.

The arch joints or beds of bosses, however, are planes, but those of fan vaults ought to be conical surfaces. This is not universally the case in practice. The joints of the vault of Henry VII.'s Chapel appear to be in many parts of the severy worked in planes. Those of Islip's Chapel are also worked in planes, as shown in Fig. 6. This is a mere diagram of a portion of the fan, and therefore the joints are not projected over the mouldings.

The fans are in this example constructed entirely of solid masonry and not of rib and panel-work. *A B* is a wall rib, *A D* a diagonal rib, *A C* an intermediate rib, and the arch joints are planes, arranged with respect to

the ribs A B, A C, A D so as to pass respectively through the axis of curvature of each of these ribs respectively. In other words, if the vault be divided by lines A b A c drawn through the middle of each compartment, every portion which is contained between two of these adjoining lines b A c A forms an ordinary arch with plane joints. But in the lower stone or *tas de charge* the joint line runs obliquely across the tierceron, and the beds are only provided for the wall and diagonal arches.

Fig. 7 shows the arrangements of mouldings which have been already alluded to as prominent characteristics of the two kinds of vaulting. In A B a rib is shown, which is intersected in its course by two liernes at a b c d. The middle plane of these liernes being as usual vertical, it is plain that their mouldings cannot mitre (as it is termed) with those of the rib, because they are placed symmetrically to their own axis, while the mouldings of the rib cross at an angle which throws them on one side below, on the other above, the corresponding ones in the lierne. This leads to great diffi-



FIG. 6.

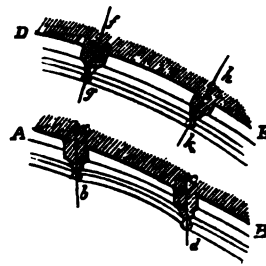


FIG. 7.

culties in the management of the intersections of these mouldings, which are in fact generally covered by bosses that prevent their awkwardness from being discovered; and we might fancy that it was for this purpose the bosses were invented, were it not that they are employed for the intersection of the crowns of arch ribs, in which no such difficulties occur, long before the liernes are introduced. The horizontal ridge ribs, however, which are much older than the liernes, present the same kind of difficulty in their intersection with the crowns of pointed arches. To overcome these difficulties we sometimes find, when bosses are not employed, that the mouldings of the rib are awkwardly warped and distorted at their junctions, as from d to b; also that the plain side of the lierne is several inches higher on one side than on the other, as at a, or else that the surface of the vault is dropped on one side to accommodate the lierne, but which introduces a similar difficulty with the rib, as at c. Nevertheless the branching and independent character of the ribs and liernes is so intimately bound up with

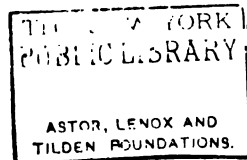
this verticality of their middle planes, so that I cannot help ascribing one of the first departures from the true Gothic character to the change in the method of intersecting the mouldings, which is the leading feature of fan groining.

This is shown at *D E*, where a rib of the same profile as *A B* is intersected by two others, *f g h k*, and by placing their axes of symmetry or middle sections perpendicular to the surface of the vault, a perfect mitring of the mouldings is obtained, and the workmanship of these mouldings is at once greatly simplified and reduced to the capacity of a much lower class of workmen. But thus the ribs and other moulded lines become at once visibly referred to the general surface of the vault and subordinate to it, decorating it nearly after the same fashion and principle as the panels and concamerations of a Roman vault, which are in like manner sunk perpendicularly to the general surface; whereas, in a genuine Gothic vault, the real surface should be subordinate to the branching ribs, and rest upon them.

The practice of thus working the mouldings and ribs square to the surface may possibly have originated with the makers of shrine-work and small canopies, which are often ornamented with very elaborate models of vaults. These are beautifully ribbed into patterns, and as the entire vault is worked out of a single stone, the mouldings are naturally sunk with reference to its surface. In the larger canopies of monuments, too, a similar method is often followed.

In all the great fan vaults the surface of operation is reduced by cutting away a considerable portion of the stone so as to bring it to the form which is shown at Fig. 4 *b*, and also in the isometrical view, Fig. 3. This is effected by removing the portions marked *x* in Fig. 4. The remaining part of the surface of operation retains lines drawn in the direction of the ribs, as shown in Fig. 4 *b*, but which are not inserted in the other drawings of the complete vault, to avoid confusion between them and the joint lines.

This portion of the stone appears to have been removed to lighten it, for from the rude and irregular manner in which it is cut away, and from the remains of the vertical surfaces *T M t m* at the lower parts of the stones, it is clear that they were first worked completely in the form shown in Fig. 4 *a*.



THE MOVEMENT FOR GOOD ROADS.

AT the next general election the people of Arkansas will vote to secure an amendment to their constitution which will permit local option in road improvement. If the electors in any county vote in favor of a public road tax at the general election for state and county officers, then the county court shall have the power to levy, in addition to the county tax, an amount not exceeding three mills on the dollar on all taxable property as a "county road tax," to be used exclusively for building and repairing roads and bridges of the county.

In a paper read before the Mansfield (Ohio) Lyceum, by G. A. Clugston, he tells of a farmer who was bitterly opposed to improving the pike before his farm. When the work was decided upon he endeavored to sell his eighty acres for \$2,500, intending to move west, but no one wanted a farm on the, then, mud road. He paid his first installment, and before the second one was due had sold enough wood and timber which he could not sell before, to pay one-third of his assessment, and he had refused an offer of \$4,000 for his farm. This rise in value of \$1,500, less his assessment, showed a net profit to him of \$1,200 brought by a good road.

The first appropriation in New York under the new road law is so small that all the petitions for road improvements cannot be granted, and it is therefore proposed to improve a section of road in each county, as far as practicable, to serve as a model.

Free mail delivery in the rural districts waits only on road improvements.

The road maps furnished to all members of the L. A. W. have long been recognized for their general usefulness, not only in pointing out the best conditioned road between given points, but they enable the rider to plan his run and save himself considerable worry. It has remained for the government to discover their value in connection with military movements. This seems now to have been done, judging from the following extract from a letter from General Wirt, of the United States Geological Survey, to the chairman of the Pennsylvania road-book committee. He says:

"It may be pleasing to you to know that I furnished from one of your books information to an army office as to the best routes for the transportation by road of a company of heavy artillery from Washington, D. C., to an objective point well up in Pennsylvania. I have also mentioned to the military information bureau of the war department that they could make good use of the L. A. W. books."

The tax we have to pay because the original cattle tracks and paths led abruptly up and down over hills seems to be as immovable as the hills themselves which cause it. Immense sums would be eventually saved if many hill roads were re-located. In learning how to improve our highways and to construct new ones, it is well to learn where lines should run, in

order to insure economy in grades and to reduce tax on time, strength, wear and tear, and maintenance caused by hills.

Writing on this subject in the Portland Industrial Journal, S. D. Gray tells of roads over hills which "must not be gone around because our fathers traveled them and we may as well be footsore as they." He cites a case "in which both town and county commissioners refused to act. This road was two miles in length, with eight rugged hills, four of them unsafe to ride up or down. All these hills could have been avoided and a level road made for less than \$1,000 that would pay for itself in less than ten years. The old hills will remain. What we need is an understanding, not how to build our roads, but to say where our roads can and should be built."

The new constitution of Louisiana allows the police juries "to set aside at least one mill per annum of the taxes levied by them, and to impose a per capita tax of not more than \$1 per annum upon each able-bodied male inhabitant . . . and to levy an annual license of not less than 25 cents nor more than \$1 per annum upon each vehicle, including bicycles, kept and used for locomotion," for the purpose of "constructing, maintaining and repairing the public roads and bridges of their parishes."

The annual report of the state road commissioner of New Jersey makes the following statement of the cost of haulage on various roads, and shows very concisely where the advantages of good surface and light grades come in. He says:

"It costs $9\frac{1}{2}$ cents per bushel to ship wheat from Chicago to New York, a distance of 900 miles; it costs 3 cents a bushel to haul wheat on a level road a distance of five miles, and on a sandy road it would cost 9 cents per mile to haul it. The saving on a bushel of wheat with good roads for a distance of five miles would be equivalent to that of 600 miles of transportation by steamer or canal boat, or 375 miles by railroad. One mile of good roads would make a saving equal to seventy-five miles of railroad transportation. Thus every mile of good roads places the producer seventy-five miles by rail nearer to the markets. It is estimated that the cost of hauling 500,000,000 tons of farm produce to market is \$2 per ton, or just about \$1,000,000,000; it is also estimated that about 60 per cent. of this last amount, or \$60,000,000, would be saved each year if farmers were able to do this hauling over good roads."—L. A. W.

Transportation is a tax. Any economy in transportation is an actual gain. It increases the wealth of a community by reducing the cost of necessary transportation. Political economists tell us that the actual value of an article is increased by simply a change of location.

Melons in Missouri are just as sweet as when shipped to Minnesota. There they sell for 10 cents apiece, but when they reach Minneapolis they

are worth 30 cents. Now, if it costs 20 cents to bring them, no profit will come to the transportation company and shipping will soon cease until facilities can be offered which will reduce the cost of transportation.

Either this or we must pay enough more at this end to make it profitable to all parties.

The farmer's produce is worth just so much at the market. This price is fixed by the great law of demand. His load of wheat will bring him, say 75 cents a bushel, and just this, whether he has been able to bring sixty bushels over a good road or but thirty-five over a poor one.

We must not ignore financial gains from good roads. In every case they have appreciated the price of land in a neighborhood to an amount equal to two or three times their cost.

Every farmer well knows the numerous advantages of nearness to school, church and market. To improve a road is to shorten it.

The actual distance of land from market is not measured by miles but by the condition of the roads. Land ten miles distant from a market reached by a road always good is nearer than that but five miles away but separated by a road frequently bad.

W. R. Hoag.

THE WORLD'S EXPORT TRADE.

CONSUL MORRIS, of Ghent, under date of June 14, 1898, says: An article published by the Antwerp Journal of Maritime Interests gives the official figures of the export trade of the leading nations of the world for 1896 as compared with 1872. Tabulating the statement therein contained, we obtain the following table:

Countries.	Amount of Exports.		Increase.	Relative rank.	
	1872.	1896.		1872.	1896.
England.....	\$1,235,200,000	\$1,422,000,000	\$207,475,000	1	1
United States.....	430,581,000	1,050,692,000	620,109,000	4	2
Germany.....	559,700,000	994,156,000	384,456,000	3	3
France.....	726,066,000	656,493,000	*69,673,000	2	4
Russia.....	270,586,000	513,908,000	261,322,000	5	5
Austria-Hungary.....	250,900,000	369,016,000	118,116,000	6	6
Belgium.....	193,000,000	283,324,000	90,324,000	7	7

*Decrease.

The most remarkable feature of this statement is the decrease in the trade of France, which has fallen from second to fourth place. The trade of the United States, on the contrary, increased more rapidly than that of any other country, or nearly 150 per cent. in the twenty-five years.

Besides the countries mentioned, Japan, Australia, and the East Indies have, in greater or less degree, increased their exports. France alone sees its trade gradually declining in the volume of the world's commerce.

OUR FOREIGN TRADE IN STONES, ETC.

From the monthly summary of finance and commerce of the United States, corrected to July 27, 1898 we compile the following:

ARTICLES.	JUNE.				TWELVE MONTHS ENDING JUNE—			
	1897		1898		1897		1898	
	Quan.	Values.	Quan.	Values.	Quan.	Values.	Quan.	Values.
Imports—		<i>Dollars</i>		<i>Dollars</i>		<i>Dollars</i>		<i>Dollars.</i>
Cement (lbs.):								
Imp. from—								
United Kingdom.....	9,658,492	31,138	2,329,400	7,691	184,287,053	596,195	113,733,295	379,759
Belgium.....	24,328,111	72,406	24,706,797	70,155	258,812,109	749,174	940,127,308	716,440
France.....	1,006,262	2,838	594,900	2,396	12,849,762	37,467	13,000,906	39,072
Germany.....	54,696,134	177,999	31,679,637	108,114	464,862,050	1,517,232	407,467,520	1,366,209
Other Europe.....	2,486,759	8,435	912,662	3,071	15,785,463	56,956	21,063,145	66,406
British North America	452,625	2,130	205,926	938	2,749,425	11,454	2,170,799	10,330
Other countries.....					809,011	3,672	5,300	67
Total.....	91,828,313	294,946	60,321,251	187,360	939,100,566	2,972,350	797,668,183	2,578,289
Marble, and mfrs. of.								
Stone, & manufactures								
of, including slate...		34,600		19,626		325,039		249,502
Total.....		100,701		69,328		1,197,208		938,956
Exports—								
Marble and stone, and								
manufactures of:								
Unmanufactured.....		9,683		7,595		66,665		95,953
Manufactures of—								
Roofing slate.....		78,479		182,006		780,112		1,370,075
All other.....		30,868		46,294		536,708		429,507
Total.....		118,430		185,895		1,883,480		1,894,535
Cement..... bbls		7,583		2,306		38,490		48,836
Exports foreign mde.								
Cement, Rom., Portland								
etc..... lbs		136,783		33,359		2,700,781		10,222
Total.....		696		130		10,222		3,938,602
Marble, & mfrs. of.								
Stone, & mfrs. of includ-								
ing slate.....		985				6,591		2,454
Total.....		1,018		1,422		16,915		3,841
Total.....		1,983		1,422		22,506		6,996

Merchandise Remaining in Warehouse on June 30, 1897, and 1898 Respectively.

ARTICLES.	June			
	1897.		1898.	
	Quantities.	Values.	Quantities.	Values.
Cement, Roman, Portland, etc..... lbs...	7,714,225	\$ 20,497	3,397,038	\$ 3,472
Marble and stone, and manufactures of:				
Marble, and manufactures of.....		17,494		45,034
Stone, and manufactures of, including slate.....		1,841		8,036
Total.....		19,335		53,070

Exports from the Dominion of Canada, During the Year Ending June 30, 1893, to 1897.

ARTICLES.	QUANTITIES.					DOLLARS.				
	1893	1894	1895	1896	1897	1893	1894	1895	1896	1897
Stone—building, freestone, etc.,										
unwrought..... tons...	31,478	21,781	34,894	43,551	23,014	\$2,108	\$9,961	\$6,369	\$4,818	\$23,587
Lime.....						\$7,898	\$4,885	\$5,058	\$4,028	\$2,259

Imports into the Dominion of Canada during the year ending June 30, 1893 to 1897.

ARTICLES.	QUANTITIES.					VALUES.				
	1893	1894	1895	1896	1897	1893	1894	1895	1896	1897
Cement, Portland or Roman, (bbl.)										
United States.....	15,425	15,019	9,976	8,279	25,137	\$29,068	\$29,789	\$16,128	\$15,148	\$40,848
United Kingdom.....	170,866	150,449	106,073	93,807	88,235	237,030	188,658	133,155	119,215	108,917
Belgium.....	33,871	56,668	40,736	79,674	84,513	48,651	60,860	49,470	78,930	83,976
Germany.....	5,323	2,075	25,800	12,814	16,700	5,325	2,496	99,363	15,442	22,043
Other countries.....	50	4,125	17,687	11,112	3,213	114	4,568	20,623	11,663	3,128
Total.....	225,534	228,336	199,568	206,186	217,798	\$10,078	\$86,341	\$24,734	\$40,388	\$25,913
Marble and manufactures of:										
United States.....						81,101	81,057	73,084	68,266	55,492
United Kingdom.....						4,142	3,608	2,435	4,742	13,394
Other countries.....						11,824	9,959	7,117	14,100	6,382
Total.....						97,067	94,627	82,636	87,108	75,268
Stone and Manufacturers of:										
United States.....						90,733	84,311	73,727	83,154	63,522
United Kingdom.....						44,028	44,405	48,338	47,165	34,442
Other Countries.....						1,063	854	507	1,342	1,557
Total.....						135,813	129,630	117,632	131,561	99,521

CEMENTS AND LIMES.

California Cement Famine Broken.

A press dispatch from San Diego, Cal., reports the arrival of a British ship, 175 days out from London, with 2,269 tons of cement for Spreckels Brothers' Commercial Company. The arrival of this cargo is said to have relieved a cement famine in Southern California. This reads like strange news to Americans, when a few thousand tons of cement must be imported from Europe on six months' passage, and American supplies in abundance within six days by rail to the famine district. We wonder why?

Process of Making Slag Cement.

A process for making high-grade slag cement from slag by the use of hydrochloric acid has been patented by Cornelius J. Curtin, of Newark, N. J.

The object of the invention is to create by the combination of hydrochloric acid with the lime a more thorough mixture of the parts, and thereby make a very much stronger and smoother cement, which mixes more readily and gives much better satisfaction in use. The formula and process of making cement under this invention are as follows: Take any given quantity of lime and add thereto about 3 per cent. of hydrochloric acid, these parts being thoroughly mixed while the acid is being added to the lime. The action of the acid on the lime causes it to mix more readily with the slag when added. After these parts are thoroughly combined the mixture is deposited in a vat of water containing about 20 per cent. of water to the quantity of mixture deposited therein. These parts are again thoroughly mixed and molten

slag is permitted to run therein until about 85 per cent. is deposited, or until the requisite consistency is obtained. It must be understood that the process of mixing continues and is continued until the whole is thoroughly mixed and combined, after which it is drawn off and dried and then pulverized into a very fine powder by any of the usual methods.

In some cases it is an advantage to mix the water and lime first, then add the acid, and then the slag in about the same proportions as above stated, the percentages being those of weight.

The Utica, Ill., Cement Company has conceded the advance of ten cents per day demanded by its laborers, who now receive \$1.35 per day.

Strength of Concrete.

A subscriber submits the following query to The Brickbuilder for an answer: "Will you kindly inform me through your journal as to the bearing strength of concrete, or the proportionate thickness to the width?"

This query is somewhat indefinite in form, and it must be answered as two separate propositions, one as to the compressive strength of concrete, and the other as to the necessary proportion of width to thickness.

Some recent tests of the strength of concretes, prepared from different cements and aggregates, have been conducted by the Engineer Department of the District of Columbia, and the results are published in the Report of the Operations of this Department for the year ending June 30, 1897, and may be

found in full on page 165 of that report. A synopsis of these results is given in the following table:

TABLE G.

No.	Composition of Concretes, by Volume.	10 days.	45 days.	3 mos.	6 mos.	1 year.
		Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
1	1 PART NATURAL CEMENT, 2 PARTS SAND.					
2	6 parts average concrete stone.	32,900	77,687	54,022	114,412	131,700
3	3 parts average concrete stone, 3 parts gravel.	15,500	52,362	85,315	90,965	121,100
4	6 parts (3/4 average concrete stone, 1/4 gravel.)					131,700
5	6 parts average gravel.	12,500	60,652	51,980	46,437	115,200
6	6 parts coarse concrete stone (no fine).			85,880		109,900
	1 PART (ATLAS) PORTLAND CEMENT, 2 PARTS SAND.					119,300
7	6 parts average concrete stone.	130,750	*343,530		351,600	440,040
8	3 parts average concrete stone, 3 parts gravel.	136,750	172,321	324,875	298,037	396,300
9	4 parts average concrete stone, 2 parts gravel.		266,962			409,300
10	6 parts (3/4 average concrete stone, 1/4 gravel.)					388,700
11	6 parts average gravel.	99,900	234,475	385,612	295,550	406,760
12	6 parts coarse concrete stone (no fine).			234,475	220,350	295,300

*There being such a great difference in the crushing of the two cubes, the strength of each cube, and not the average, is given.

crete is to form the footing for the support of a wall or pier, the relation of thickness to width will depend upon the nature of the soil or foundation upon which the concrete is laid and the amount of load that it is to carry. Each particular case must, therefore, be considered by itself. For piers for the support of heavy machinery the concrete may be several times thicker than wide, whereas, as a base for pavements, it may be made many times wider than thick.

Iowa Portland Cement.

In the report of Plymouth county, H. Foster Bain, assistant state geologist, of Iowa, announces the discovery of certain beds of chalk suitable for manufacture into Portland cement. Chalk for this purpose should have at least 71 per cent. of calcium carbonate. Samples from these localities show from 83 to 94 per cent., and have very little impurity. Chalk from the same formation as that out-cropping in Plymouth county has been used for some years in making cement at Yankton, S. D., and the excellent quality of cement which can be made from it has been proven at the latter point. It is only since 1890 that Portland cement has been manufactured on a large scale in America. Since then it has come to be used in many ways never before thought of. There is manufactured now more than as much cement as was imported in 1891, and there is as much imported as ever. Consequently prices are down. American ingenuity has so completely made over the process of manufacture, particularly in burning, that the United States is getting ready to take her share in the foreign trade. One of the largest and best equipped German factories has recently, after investigating American methods, taken to Germany and set up a complete American plant.

Cement Prices Down.

Louisville, Aug. 1.—The cement war is still raging between the mills represented by the Western Cement Company and those which are out. During the month of July cement has dropped fif-

Additional information is also contained in Baker's Treatise on Masonry Construction, page 109, from which it appears that hydraulic concrete, made in various ways with natural cement, may have a compressive strength of from 65 to 85 tons per square foot in cubes at an age of six months, and with Portland cement a strength of from 144 to 219 tons, results which do not differ largely from those obtained in Washington.

The necessary relation of thickness to width of any concrete mass cannot be fixed by any general rule, but is dependent upon the particular conditions under which the concrete is used. If the con-

teen cents a barrel, or to forty-five cents at the mills, which is almost unprecedented. The result of the fight has been that some of the weaker mills have been compelled to close down. Another result has been to extend the market for Louisville cement. One of the biggest manufacturers said yesterday: "Louisville cement factories have considerable opposition in different parts of the country. Utica, Ill., Milwaukee, Buffalo, Rondout, N. Y., and western factories are all brought into competition with the Louisville article. When the price is at normal, as it was when the Western Cement Company handled the whole product, the Louisville product only entered a certain territory. As soon as the price of the Louisville article goes down, it can be shipped into competitive territory and sold against the other cement, because Louisville cement has a reputation second to none in the country.

"The cut in Louisville cement has been so great during the past month that the other cement companies all over the country have been compelled to make a cut, but to nothing like the figures made by the Louisville manufacturers. There is no telling when the cutting will stop or the war end. Several new mills are going up over the river, and they will want a market for their goods. It is likely that this will be secured by making another cut."—Journal.

A short time ago a large plaster mill was erected in Marion county, Kansas, at a cost of \$15,000. The mill was supposed to be on the richest vein of cement for making stucco in that part of the state, but after working it for awhile it was found that there was simply a "pocket" and that it could not be extended for much distance in any direction. The supply grew less and less, although the mill had orders for scores of carloads of cement, it has been compelled to stop. It is proposed by a new company to buy the mill and take it apart, then move it to some other location. Not only is there no prospect of the Blue Rapids mines giving out, but there are a score of gypsum beds that have never been touched.

Penitentiary Stone Business.

From the report of the warden of the Joliet, Ill., state penitentiary, we learn the following summary regarding the stone business of that institution for the past three years:

Profits Sept. 30, 1894.....	\$26,457 52
Profits Sept. 30, 1895.....	16,222 83
Profits Sept. 30, 1896.....	16,589 91

Total profits.....	\$59,270 26
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Loss Sept. 30, 1893.....	\$ 3,981 55
Loss Sept. 30, 1897.....	19,351 21

Total loss.....	\$23,332 76
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Leaving net profits from July, 1893, to September, 1897.....	\$35,937 50
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Number of days convict labor during above period, 110,533.

Making average earnings per man per day, 32.50 cents.

The Joliet Stone Quarry Strike.

Joliet has been known for years as the Stone City, but the way things are moving, its stone business will soon be relegated to our records as a past industry. The present labor trouble during the busy season has paralyzed all efforts that were necessary to make it hold its own against concrete, that is fast becoming a factor in forcing it out of the field.

On every railroad line to Chicago, as well as in that city, evidences are apparent to all, of the walls and buildings erected and in course of construction of concrete material where stone structures should be, under favorable and conciliatory conditions of operators and workmen. The danger to the stone industry is the encouragement and headway given to the concrete constructors who are becoming expert in its use. It not only strikes at the quarry interests in capital and labor, such as stone masons, as common laborers can fill the requirements in concrete construction.

The quarry strikes of the past have always been badly handled, owing to the methods used in enforcing their demands. There was no union, but acting under an impulse one quarry of workmen would hold a meeting, decide on a strike and like an invading army would march on

the various quarries, and gaining strength and numbers, would coerce the others to take like action. Such a course of procedure being contrary to the constitution and spirit of law and liberty, as well as order, placed them in opposition to all good citizens, as well as their employers, and the case in dispute was at once ignored.

The start of the recent strike was much along the same lines. Some days elapsed, and not until a union was formed, was there a united demand presented? Much was expected on all sides from the union once established, but up to the present no results satisfactory to any interested have been reached.

The stone industry of the city has had enough to do to hold its own without the inauguration of a suicidal struggle by the very forces that should be combined in its defense. It is a question in which all interested in the welfare of the city and community, that have any influence to bear on the contending parties, should exercise it at once, bring them together, talk over the situation and not only solve the present difficulty, but establish a system that would render strikes, without an intelligent effort to arbitrate, a future impossibility.—Joliet (Ill.) Journal, 30th.

Stone from Frontenac.

Those who entertain sentiments friendly to Winona stone, and who some day hope to see the outlying quarries counted upon as among our leading industries, are jubilant over what they consider a signal victory for the dolomite stone.

From New York comes information that the stone from this section, which has not been considered worthy of use in local public institutions, has been selected for the construction of St. Stephen's Church, a new edifice about to be erected for one of the wealthiest congregations of the metropolis.

The quarries thus favored are at Frontenac, where practically the same conditions maintain as at the local quarries, save that the rock industries there have

been developed. The stone is precisely the same as the local stone and is declared to belong to the same rock formation that extends through this entire section.

There is naturally much unconcealed joy over the proposition, for an opportunity is presented to demonstrate the worth of the stone not only for general building purposes but for decorative features as well. It will be employed not only in the construction of the exterior, but the interior, which will be finished in solid masonry, presenting a bold and unique appearance calculated to awake admiration in all.

That in a competitive test against the leading quarries of America the dolomite carried the day is enough to encourage all who are interested in the development of the quarries. Experts declare that there is not even a trifling difference between the product of Frontenac and that of our own hills. It is comforting to those who have heard local stone denounced as impracticable to learn of the success when put to test of one of New York's leading men in that line.

Frontenac is to be congratulated and Winona stone men should profit by the example and "hustle" after the "good things" that crop up in their line, and do something to demonstrate the possibilities and value of their holdings.—Winona (Minn.) Herald.

Timber and Stone Ruling.

The commissioner of the general land office has made a ruling of considerable importance in regard to timber and stone applications. In future the applicants for land under this law must have actual knowledge by personal observation of its character. The old system of accepting applications at the land office for timber and stone filings on general knowledge obtained from other parties will be abandoned. From this time forward no applications for timber and stone filings will go on record unless the applicant has personally examined the land.



Pennsylvania's Slate Quarries.

Slate quarries vary in size, being about 100 by 150 feet, and 50 feet deep. A bed of slate about four feet thick is the average, with ribbons between. A "ribbon" is a thin belt of slate. The "fault" in a quarry is the slide of one part of the stratum upon the other, and is from six to twelve inches wide, filled with white calcareous spar and fragments of slate. The best roofing and school slate lie deep in the quarries. An average medium quarry turns out about 150 squares of roofing slate a month. It has one cable derrick to hoist slabs of slate, and about five shanties, wherein the cutting and splitting is done. Some quarries have two engines, six cable derricks, and a few dozen shanties. Many years ago the Bangor quarries had forty-two shanties, sixty men at work quarrying, besides the drivers, engineers and splitters. An average quarry can produce 5,000 squares a year. Four squares is an average day's work for a splitter.

Some years ago when the big Chapman quarry was running in full blast in Pennsylvania, it had six cable derricks run by independent engines. They had thirty shanties in operation and hoisted stones 150 vertical feet and 300 feet horizontal in two minutes. At some quarries blocks of stone are taken out twenty feet square. The old North Beach Bottom quarry furnished the floors of the United States patent office in Washington.

Slates are mined from open quarries, by day labor or by contract. At some places the owner lets the quarry out, paying a stipulated price for slates deliv-

ered on the bank. From four to six men take a contract to quarry and dress slate. Derricks, pumps, mine cars, waste boxes, chains, drills, hammers, crowbars, sledges and splitting chisels are used in the quarries.

Slate is quarried by drilling holes and blasting. Skill is necessary to use the smallest number of holes to remove the rock without shattering it. The holes are drilled at right angles to the cleavage. The rock is hoisted to the surface, put on a truck, run into a slate-maker's shanty and dumped. It is then cut into blocks of suitable size for splitting into slates, the test having been made to see which way the rock splits. A broad, thin chisel is used, and it is wonderful to see how this rock can be deftly split, middle in middle, until the thickness of roofing slate is reached. Dressing machines square the slate.

School slates are softer than roofing slates and have a finer grain. They are polished, framed and packed by the millions. Where heavy slate slabs are prepared, they are generally sawed, trimmed and polished, and not split. School slates average ten dozen to a case and weigh on an average 150 pounds. The old J. W. Williams quarry at Slatington, Pa., was opened as far back as 1812.—New York Commercial.

The Collapse of the Slate Trust.

The sensation of the week has been the collapse of the Vermont Sea Green Slate Company, otherwise known as the slate trust, says the Granville, N. Y., Sentinel of August 5. It has been apparent for some time that would be the

ultimate result. No institution could exist under similar conditions. The members were suspicious of each other. Each member believed that the other members were secretly working a flim-flam game at his expense. The worst kind of crookedness was charged and so, amid a tirade of hot words, the company was dissolved. The collapse of the company is to be regretted. It was organized for the purpose of maintaining prices as well as wages. If it failed in its purpose then it might as well go out of existence. If the members did not conform to its rules and regulations, the organization was useless.

For the past six months the slate trust has been little less than an organized war dance. Every member admits that its object was a meritorious one and regret that conditions have forced the company to dissolve. Yet these very men had it in their power to continue the organization. There was a similar racket several years ago and the company went to the wall. Then followed eighteen months of disastrous competition, when slate was practically given away. With that expensive experience the slate men were convinced that their salvation depended on organization, and the trust was revived in 1895. Now it goes down again. There were members of it who have told the *Sentinel* that its non-existence four years ago cost them thousands of dollars, yet they court a similar experience. A business of nearly \$1,000,000 was annually transacted through the trust.

It is now asserted that a war of cut prices will be inaugurated. It will be every man for himself and the devil take the fellow at the rear of the possession. Suspension of work, or the reducing of the working force and a cut in wages are said to be the next step. Gen. Hughes led the movement Tuesday by discontinuing work in his quarries for at least a month, some 225 men being laid off. The *Sentinel* does not learn that any of the other manufacturers will suspend work, although labor may be curtailed and wages reduced. Hughes is loaded up with slate and must reduce his stock before cold weather.

Supervisor Norton claims that his firm (Norton Brothers) is hit the hardest by the dissolution of the trust, as one-third of the entire amount of slate held at the present time by parties forming the trust is owned by his firm. He asserts that he has been the victim of misplaced confidence, that while he has been living up to the stipulations of the trust, others have been recently disposing of their stock at cut prices. He must now go into the market with his slate and compete with a product produced by cut wages. Mr. Norton did not apprehend that the breaking up of the slate pool would seriously affect the town's business or prosperity.

This afternoon the *Sentinel* learns that the Anniflan Slate Company will close its quarries this week. Griffith & Nathaniel, of Poultney, have laid off twenty men.

A meeting of the striking employes of the Northampton Hard Vein Slate quarry, Pen Argyl, Pa., was held to consider the company's proposition in relation to increase in wages. The men having struck for 90 cents per square, the company would not accede to this demand. They offered the men 85 cents per square, an increase of 4 per cent. from what they received before the strike. The men then agreed to put this to a vote to see how many men were willing to go to work at this price. There were ten men in favor and thirteen were not in favor. But after this one of the strikers arose and said he must work and would go to work. The strikers' committee composed of three, then reconsidered this proposition and agreed to go to work at this price, thus ending the three week's strike at this quarry.—Index.

The Carbon Slate Company, of Slatington, Pa., exported during the month of June 11,403 squares of roofing slate, or 192 cars. Their largest single export shipment was 7,179 squares, which required 120 cars to carry it to New York. This company has shipped during the first six months of this year 30,394 squares or 530 cars, 28,109 squares having been sent to foreign markets.



TIMELY TOPICS

The Monument Trade.

Our advices from the monument branch of the stone trade indicate an improved condition of business. The demand is good, and the percentage is in favor of a relatively higher grade of work than during several years past. This is a symptom that money is becoming more plentiful, and confidence in expending it much firmer, because people invest in such things as memorials only when they have money to spare and have faith in what the future promises for acquiring more of it. The monument business is a fair barometer of commercial conditions, and at present there is no doubt that it is more active than for several years.

Convict Labor.

The State of Illinois has made a net profit of about \$7,000 a year for the past five years from the use of its convict labor in stone-work at the Joliet penitentiary. It has probably done better at its Chester institution. The average earnings of each convict in this class, for the time stated, was 32½ cents a day. We believe it costs the state less than 15 cents a day to care for a convict, so the state is making about 100 per cent. profit on the utilization or sale of its convict labor in stone-working. Add to the earning capacity of the convict the difference be-

tween it and the price paid by the contractor for it, and one can get an idea of the profit made on contract convict labor. It is charged against the Joliet institution that it is turning out stone-work for jobs as far away as Eastern New York. If this be true it is not to be wondered at that strikes are frequent in that section, or that New York state should pass embargo laws on the importation of dressed stone.

Joliet Strike Ended.

The settlement of the Joliet quarry strike is a sort of double-end victory. The operators have gained the concession of a ten-hour day at 15 cents an hour, good for the active working season, and the quarriers have gained recognition of their organization and the precedent of arbitration of future disputes, should any arise. This is a gratifying outcome to a very unpleasant affair. It has its moral in the triumph of the principle of arbitration, or rather, the concession that even quarriers, whose standard is not above slavish labor, are deserving of recognition when it comes to a dispute with their employers. We append the remarks of Mr. Kraker, one of the pioneer quarrymen, at the conference that settled the strike:

"This is the first time I have been asked to present my views or to confer with the quarriers. I am of the opinion

that if the quarry owners would enter into a contract to pay the scale as demanded the scheme might be a success, but when but a part of them, and that part comprising the largest part of the operators, refuse to pay the prices asked, the burden falls upon the smaller operator, and he is practically ruined. The larger operators are paying \$1.50 for ten hours' work, and they are in a position to control the market. The present war, the competition with concrete, the Naperville, Geneva, Wisconsin, Ohio and Indiana quarries have all worked a depreciating influence upon the local industry, until now the business is almost ruined, and the wages asked cannot be paid, unless all of these owners will agree to a scale."

So, it may be inferred from Mr. Kraker's statement, which is corroborated by other operators, that the quarriers' demand was not so indefensible as the managers of the Western Stone Co. tried to make it appear. The ability to pay \$1.75 for ten hours seems to depend entirely upon the common consent of the quarrymen. If all accepted that scale, all could operate at a profit, but without the consent of the Western Stone Co., the smaller operators could not. And that ten hours' of honest labor in a quarry pit in summer is worth \$1.75, we think no one with any kindness in his heart will dispute.

The Spoils of War. The war is over—but hostilities have just commenced!

The army and navy have soundly thrashed the enemy, but the nation is confronted with the mightier problem of checking itself. "To the victors belong the spoils," but who will be crowned the victors, the people or the rapacious syndicates? The war of the trusts, and of the trusts with the individual who will seek to rise independent of them, will follow as the inheritance of the conflict just ended, as it followed

the close of our civil war. Out of it what will the "heroes" of the rank and file whose courage and endurance made victory assured, get for their measure of self-sacrifice? A grateful nation tendered to the survivors of the Union forces such portion of the wilderness of its territorial domain as they might select, on which to retire and slowly starve to death; and it gave to the land and railway syndicates all that adjoined, so that the process might be made certain. Will the same grateful nation repeat such generosity to the survivors of the Spanish war, and tender them preferred rights to untitled and untitled lands in its West Indian possessions and what it shall keep of the islands in the oriental sea, and then bequeath to the syndicates, already numerous, and others which will be quickly organized, all that remains? No such problem over the distribution of the spoils of war ever confronted a nation as this one now before the United States. If it follows the manner of its previous doings, those who have won the reward by blood and suffering will be shorn of it by the privileges vouchsafed the monied interests. It is a pity that the soldiers and sailors whose valor won for the nation these rich possessions could not receive undisputed title in them, before others get claim to them. But it will not be so.

Organization in Monument Trade. It is not clear to us what the retail marble and granite dealers of

the country intend to accomplish by a national organization. We think we understand what they hope to accomplish. While writing of the collapse of the Sea Green Slate Trust the thought came that from that finality one could read an object lesson for this new movement of the monument dealers.

The idea of the slate men was to make money by inducements to make members honest. Instead of realizing that object, it put a premium on dishonesty. It afforded security to the honest dealer, but misplaced its confidence when it offered the same protection to the dishonest dealer. Now, that is just the way these forms of communion between business men invariably end. And if a couple dozen competing firms in the same line of trade cannot be held together for the common weal, what a stupendous farce will likely be the effort to compact into state and national organizations ten thousand or more business concerns, individually and collectively assailed by diverse evils.

Now STONE favors organization in every branch of industrial and commercial enterprise. It is a good thing when wisely conceived and wisely managed. But we have lived long enough to learn for a certainty that no organization based on a theory that all members will remain true to its principles, when individual welfare is disturbed thereby, can hold intact any considerable length of time. It is one of the impossibilities to frame a code of rules that can be executed with impartial justice to every one. No law, human or divine, can be so administered by man. Simply because man looks many ways at justice. "Thou shalt not steal," is plain enough in its mandatory sense, and yet what man lives who is not a robber in some sense? The essence of all law is that one shall deal justly toward another, but who is to measure the quality of justice to dispense? The nearest we can come to it is to satisfy our conscience that we come as near to it as we can. Hence, it comes to be simply a question with the individual member of a voluntary organization of business men what degree of sacrifice he is will-

ing to make for the benefit of others. If we do not misjudge the purpose of this movement to organize the retail marble and granite dealers, that is what will be expected of each dealer who joins. It will contend for better prices for monumental work. Everybody but the customer will commend them for that. But the matter of making a price for what one has to sell, is universally a personal right that the law of the state guarantees to every one. An organization may dismiss a member for selling below a price established by it, but that is as far as it may go. The degraded member will remain a perpetual thorn in its side. He will multiply marvelously fast if his example proves it pays. The matter of credits is also nobody's business but of the firm that places them, however pernicious the practice of some may be upon the trade of others. The resolution "That any failure on the part of a manufacturer or a wholesaler to live up to the laws established by this association, and to assist us in our efforts, shall entitle such manufacturer to none of the business of the members of said association," the association had better withdraw, or at least make it dead letter. That's a threat which, enforced, would constitute an act in restraint of trade by conspiracy, and there are court rulings by the score covering it with severe penalties. In truth, should this association set aside moral suasion for concerted force in the effort to correct the known flagrant ills that afflict the business of selling monuments, it will follow a beaten path to failure. It is not within the epidermis of an American citizen to kindly tolerate any interference with his personal rights. We believe there is one probable and one possible way for the retail dealers to greatly help themselves out of their misfortunes.

The probable way is suggested by Mr. Prior, and embraces the coöperative idea of ownership of quarries and mills. This might work all right for district associations. The possible way is through an exemplification of what wise and honest administration can do in holding men to a common purpose. The impossible way is by any means of coercion whatsoever.

A Broken Trust. The Vermont Sea Green Slate Co., often referred to as the Slate Trust, has collapsed. It is stated the scheme was faulty, and this gave opportunity for members not distinguished for fidelity to agreements, to violate the rules to such an extent that the combination was of no advantage whatever. It is the old story—a war of prices. The rates, established by the company were always fair for the fellow who got the order, but the operator who missed getting it by a slight margin was prompted to a cut below them next time. This "trust" was not of the nature of the proverbial combine, or pool, it was simply an agreement between the individual slate producers in the Vermont and New York slate belt, to establish prices and wages and stick to them. It was easy to make a scale, but not so easy to make it stick. Under the system of this "trust" each subscribing firm retained its individuality and sold for itself. When it got an order it could not fill it was turned over to the syndicate manager who gave it credit for the sale. All sales of all companies were required to be reported to the general office, as an evidence of good faith. A wheel within a wheel. It is alleged some members failed to make report, and therefore, the trouble. While the "trust," in a sense, controlled the output, the members, individually, con-

trolled the important matter of selling it. In this way the honest member was loaded up and the dishonest member fired him off. Such combinations were never permanently maintained, not even among the godly, and what reason is there to expect that conscienceless ones brought into them could be controlled. It is a pity that a collection of business firms, one and all with a common grievance, cannot maintain an understanding, but the experience in a thousand efforts to do so proves it is impossible. The trust that succeeds is the one that scorches the pocket-book, and not the one that sears the conscience of the member. Property sold to a syndicate company occupies a very different relation to it than one whose moral obligation is simply loaned to it. Next time the sea green slate concerns pool interests it will very likely be with the understanding to concentrate the management both as to operating the various works and for the disposal of the entire product of them. That is, perhaps, what should be done.

Demand Unlimited; Prices Falling. Other people than publishers and stone producers and manufacturers have trouble in earning profits in these days of scant orders and narrow margins. An adjunct of the stone business that would seem to be warrant against loss, is the cement trade, because the demand would appear to be greatly in excess of the capacity to supply. The report from every quarter is a cry for more cement. An item elsewhere says a famine existed at one spot which could only be broken by the importation of cement from Germany on six months' passage. New cement factories are coming forth in many quarters, the old mills

are running night and day, and we are importing at the rate of about 70,000,000 pounds per month right along, and are still hungry. At the height of all this apparent prosperity a war of prices rages fiercely at the main center of cement production in this country—Louisville, Ky., and vicinity—causing a drop of 15 cents a barrel during July, and bringing the price down to about 45 cents a barrel at the mills, a figure at which it cannot be made to show a profit however large the quantity turned out. Verily, a peculiar state of things.

Macadam Roadways. It is gratifying to observe that everywhere more attention is being given to the proper construction of macadamized roadways. This is what must be taken as the real meaning of the vast increase in the number of stone-crushing plants of the country. While there is a growing demand for crushed stone for concrete construction and for street paving, and immense quantities are required for these purposes, still the greater demand comes from the good country roads movement that has taken such a firm hold everywhere. People have come to understand the immeasurable advantages of smooth, solid and well-conditioned roadways, and have generally set to work to build them. This makes a demand for crushers, and for the spalls product of local quarries, for the boulder harvest alone is rarely sufficient to supply the needs even in the most rocky sections. This follows as a result of a better knowledge of the construction of macadam. They are not "dirt roads" any longer. They are made to resemble boulevards, and are by all odds the best pattern of roadway for all kinds of traffic that can be laid.

Local Discoverers of Marble.

A local marble dealer vividly describes the way he is bothered by the men who come to him with samples of some kind of marble they have unearthed somewhere in western Massachusetts, and for which they are trying to find a market. "You can always tell one of those men," he says. "He walks into the place with a mysterious air, fumbles in his pocket, and brings out two or three of his rocks with a triumphant expression. The samples are generally gook-looking, but western Massachusetts marble is apt to be disappointing. There is a great quantity of deposits of the hard, but coarse marble that is found at Adams, Lee, and in many parts of the western Massachusetts mountains, but marble of fine white, or of colors suitable for decorative purposes, is not often found in those parts. A good deal of the marble shipped is far from being hard enough to wear, and if you take a piece of such stock the size of a pea, you can crumble it to dust by rolling it in the hands. There is a good deal of marble that is black, or of colors not suitable for use for artistic work, and but little of the finer colors that are found South. Veins of marble oftentimes are of such loose material that they crumble in working, and often have deep seams that split apart after the stone is taken out."—Springfield (Mass.) Republican.

National Stone-Cutters.

The annual election of the Journeymen Stone-Cutters' Association of North America has recently been completed. The 12,000 members of the Association vote by unions on the electoral plan. The officers elected are as follows: President, William J. Clifford, Cincinnati; vice-president, Edward J. Cummings, Worcester, Mass.; secretary-treasurer, James F. McHugh, Washington. Executive board—L. H. Fitzgerald, Denver; James A. Gowan, Fort Worth; William P. Tobin, Washington; Robert Semple, Cleveland; Charles Butterworth, Kansas City; John Mortimer, Lincoln, Neb.; Alex. Bruce, Toronto.

Stone That Changes Colors.

"While doing some work up in eastern Kentucky and southwestern Virginia about nine years ago, I saw a remarkable natural wonder," said an old civil engineer yesterday.

"You have, of course, seen the chameleon, that wonderful little lizard whose color changes as do the views in a kaleidoscope, but I doubt if you ever saw limestone that exhibited an infinite variety of different colors with the coming of every new season. Such a curiosity I viewed in the Kentucky mountains, and I have never been able to satisfactorily explain the phenomenon.

"I first noticed the pinkish looking limestone while surveying a proposed railroad almost on top of the mountain near Cumberland Gap, and asked one of the men from the Virginia side what caused the stone to have such an unusual color. He said in hunting he had seen the stone yellowish, blue, brown, almost black, a dark red, nearly white and pink. He said he didn't know what caused it to change its color, but his father, an old woodsman, had attributed it to the changes in the weather. I was in the neighborhood about three weeks. One morning about a week after I had first noticed the stone and just after a hard rain, I went to look at it again and found it was a dark brown. The next time I saw the wonder its top was black almost all over and looked like it had been dyed, while the sides were of a greenish hue,"—Louisville Post.

Value of the German Workingmen's Insurance System.

Time is proving the practical value of the German workingmen's insurance system. If I return to the subject again, it is because I believe it to be one deserving a great deal of attention. The social and economic influence of so gigantic a system must be very great.

The object of the system is to alleviate the sufferings of workmen and their families: (1) In cases of sickness (sick insurance); (2) in cases of accidents incurred at work (accident insurance); (3) in cases of feebleness, wasting diseases,

decreased capacity for work, and old age (invalid and old-age insurance).

In cases coming under No. 1 there is given free medical treatment; sick money—that is money during period of sickness with which to obtain medicine, nourishment, etc., or, if desired, free treatment in a hospital and support for the family; and money, in case of death, is supplied the family. The fund is furnished by employers and employed—the former paying one-third, the latter two-thirds.

In cases of accident insurance the parties receive support during convalescence, from the fourteenth week after the accident happens. Money is given the wounded person from the fifth week. Rents are paid from the first day of the fourteenth week after the accident. The rents amount to two-thirds and in some cases to three-fifths of the workman's yearly salary.

The fund for burial expenses is furnished by the employers. In cases coming under invalid and old-age insurance, the parties receive rents from the time they are unable to work, without regard to age; old-age rents, from the seventieth year, even if they can work and do not draw invalid rent; as assistance against disease so as to prevent incapacity. In case of his death or marriage, the full sum paid by the party is returned.

The following amounts were paid out in the years given:

Year.	Sick insurance.	Accident Insurance	Invalid and old-age Insurance.
1885-86 ..	\$ 23,905,005	\$ 460,625	.....
1887	13,138,099	1,412,030	.....
1888	14,651,637	2,304,173	.....
1889	16,892,097	3,442,503	.....
1890	20,013,420	4,835,041	.....
1891	21,243,594	6,289,483	\$ 3,643,089
1892	22,433,499	7,696,967	5,344,742
1893	24,269,264	9,082,984	6,700,509
1894	23,702,063	10,539,044	8,332,475
1895	24,947,731	11,929,940	10,221,647
1896	26,114,026	13,608,747	12,293,533
1897	26,207,417	15,252,301	14,161,000
Total..	\$257,517,856	\$86,847,842	\$60,696,997

During the years from 1885 to 1897.

employers had paid in 1,337,741,176 marks (\$318,382,399), and workmen 1,173,499,805 marks (\$279,281,053), a total of 2,511,190,981 marks (\$597,663,452). Of this amount 1,702,184,100 marks (\$405,121,816) have been paid out. Thus the workmen have already received 528,700,000 marks (\$125,830,600) more than they have paid in.

The annual amount paid out is increasing at the rate of 15,000,000 marks (\$3,570,000) per annum. The reserve fund at the end of 1897 was, in round numbers, 850,000,000 marks (\$202,500,000).

For every twentieth person of the Empire's population, one has been paid insurance.

Besides this system, there are others by which workingmen are aided. There are state and private insurance and pension systems. One alone, the Miners' and Smelters' Union, paid out in the years 1895-1897, inclusive, 320,000,000 marks (\$76,160,000). From 1900 on, the annual amount to be paid out will be upwards of 300,000,000 marks (\$71,400,000), or 100 marks (\$23.80) for every working day in the year. Whether a system which makes so much for paternalism is one to commend, I can not say. Its effects here have been anything but bad. Poverty, in spite of poor wages, is practically unknown.

J. C. MONAGHAN, U. S. Consul.
Chemnitz, June 6, 1898.

Building Operations and the Close of the Conflict.

At this writing rumors are flying thick and fast at Washington, London and Madrid that Spain is about to sue for peace. There is also much talk of an armistice, with the prospect that it will prove but the forerunner of permanent peace. The temper of the population of Spain is probably such that

another and final crushing defeat must be visited upon them before they will be in a frame of mind to recognize the utter hopelessness of their cause. It is altogether probable that such an event will occur during the present month, which may mean the absolute extermination of the Spanish navy.

Already the close of hostilities is being discounted in financial circles abroad and at home. The extra-cautious, who have been watching defeats of Spanish arms upon sea and land, are preparing to put forth their efforts in the expansion of legitimate commercial enterprises. Building operations in a majority of our cities have been adversely affected by this conflict, and they await only the impulse of peace to give them renewed life and activity.

Even in these lethargic weeks of mid-summer the quickening throb of renewed building activity is felt as the result of these whisperings of peace and rumors of peace. The great financial exchanges give heed to them and are governed by them. These rumors are born of the inevitable—the logic of the situation. Spain is at the end of her tether and the great world of finance feels it and knows it.

With this incubus of a great war removed, building operations are improving. With Spain's last ship shot from under her, and her Cuban forces panic-stricken and at the mercy of our army and navy, the end is clearly in sight, whether Spain be actually suing for peace or not. The indications are unmistakable that this war has at most but a few short weeks yet to live, that it will be a thing of the past by the time our fall building season opens, and that with no war to distract us or absorb our attention, the fall building months of 1898 will be brisk and active and characterized by liberal expenditures.—American Contractor.



AN URGENT APPEAL FOR ORGANIZATION.

Retail Marble and Granite Dealers of the United States, lend me your ears: At a mass meeting of the marble and granite dealers, held in Council Bluffs, Iowa, July 12 and 13, 1898, the National Marble and Granite Dealers' Association was organized and officers elected to hold till the next meeting which is to be held in Chicago on the second Wednesday of February, 1899.

The plan is to form State Associations, where they do not now exist, which shall be subordinate to the National Association. The meetings of the National Association are to be composed of delegates elected from the State Associations pro rata to the number of members in good standing in said State Associations.

The wholesalers are not to be members of this National Association, but we are assured that the best of them will aid us as much as in them lies.

This movement is generally considered to be the key to the situation, and we now have a nucleus that we know we can make a success of it. The benefits to be derived from so strong an association as this will become, in the winter of 1898-99, will be so patent to all that I need not here outline them.

The first thing to do, however, is to immediately go to work in your own state (if you have not an Association) and form one to meet in December or January next, perfect an organization, send delegates to the National Association, and we will "fight it out on this line if it takes all summer." But it will *not* take all next summer to fight it to a finish. The trouble with the State Associations has always been that we were too weak, but with the strength we are promised by next February we will be able to accomplish what was impossible heretofore. We can ask what we will of the wholesale men and it will be given us.

Let those dealers who are eligible to membership in the states get in the "band wagon" at once, or they will "get left." "In union there is strength," and we have united our forces. Do not wait for some other dealer in your state to make the first move, but go to work yourself and write to other dealers and urge immediate action. This will necessitate some one (or ones) advancing a little money to get out calls for meeting, etc., but the Association will repay that. The undersigned, or J. N. Kildow, secretary, of York, Neb., will furnish any further information relative to the National Association or State Associations, if called upon.

Do not delay. Do not wait for some one else. Let us make a long pull, a strong pull,

and a pull all together, and we are sure of weeding out most of the evils connected with the business at the present time. Do not doubt this for a moment. It will cost each one but little to try, and we are sure that at the Chicago meeting we can demonstrate that we are not dreaming. Yours, for success,

J. M. GRAHAM, Prest.
Des Moines, Iowa, July 28, 1898.

CLEVELAND, O.

The state of trade here has not changed since my last report, nothing new of importance having appeared this month. Three brick jobs with their necessary stone trimmings is all that appears on the list of building permits issued the past week. All that I can say is that all hands are working at present.

There is considerable newspaper talk of a new Public Library, but like many other needed improvements in this city the newspapers will have to build them at least a half dozen times before they will materialize.

The High Schools are still "out of sight."

GEORGE.

FAIRMONT, W. VA.

I have not much news to write this month. I want to tell you that the long looked for court house has again started. They propose to put it up to the roof this season, which will be two stories. There are now employed eighteen stone-cutters, but more will be employed later.

We are having the town improved by a system of sewerage, and an electric railway is expected to run through this town to adjacent towns, this being a center.

A few stone cellars are being built. There is some talk of putting up a bank building here, with a granite stone front, but perhaps they are waiting for the war to cease. ABERNETHY.

KANSAS CITY, MO.

A considerable amount of building is going on in this city, but stone is not used to a great extent.

On June 29 the contract for a basin was let by the Park Board to A. Sutermeister for \$4,195. It will be of Bedford stone, and all ornamental work. Two more of these basins are contemplated and one was let on July 6. All bids were rejected and the plans referred back for more elaborate designs. The Park Board got the cash ready but it seems the bosses in this city are figuring too low.

The Union Depot Company is now spending \$30,000 for renovating the old union depot. This doesn't look much like building a new one.

The Phoenix Company have the contract for the Silverdale trimmings on Mr. Perry's \$40,000 residence. The house was to be finished on the return of his family from a European trip. They met their fate in the Burgogne disaster.

notwithstanding which the house is being built. *

The Phoenix Company has started cutting for the Convention Hall; it's Silverdale stone; also on the J. A. Bayles residence, three stories; trimmings and Portage red stone; and I understand they got the trimmings on the M. E. Church South on Fourteenth and Olive streets, and some minor residences. C. E.

ROCHESTER, N. Y.

At present the state of the stone trade is very dull, not more than fifteen men cutting on building work. Quite a few of our men are cutting curb, which we succeeded in having shipped into our city in the rough. If it was not for that quite a number of our boys would have to hunt fresh pastures.

There are two school houses to be let in the course of a month, with quite a little stone in them. There are also sixteen buildings (Home for Epileptics) to be let this coming week at a place called Sonyea, forty miles from here. They are to be of brick with stone trimmings, the stone work amounting to about \$25,000.

McELROY.

SAULT ST. MARIE, MICH.

There will be one small block worth \$3,000, brick with stone trimmings; one block, \$9,000, brick; one \$8,000, all to contain native rubble stone; one public school building to cost \$20,000, brick with stone trimmings; one Catholic school, \$7,000, brick, stone trimmings; all to be built soon. But there is enough and more men here to do the work.

The water power canal is let but we don't know who secured the contract. Have heard it is a company from your city. MILLER.

DAYTON, O.

The Wolf Tobacco Company's new building is now going up fast. The building is of brick and Bedford stone trimmings. L. H. Webber has the stone work.

The Pierce residence is to be of solid stone: The foundation is almost ready, but the plans for the upper stories are not.

L. H. Webber has received contract for school house in Piqua, O. The building is to be of brick and Cleveland, O., stone trimmings. They have also been talking about a new Catholic church. I am not sure of this but will let you know more in my next letter.

The contract for a new church for colored people in Xenia, O., has been let. It is to be of brick with freestone trimmings. Mr. Talbott has the stone work. D'ONOFRIO.

GRAND RAPIDS, MICH.

The Michigan Bell Telephone Company have awarded their contract to Green & Co. of this city.

Architect Robinson has prepared plans for an office building for the Valley City and Oak Hill Cemetery; cost about \$3,500.

There a few small jobs being carried forward, but of not much account.

The managers of the G. R. & I., C. & W. M., D., G. R. & W., and M. C. railroads are talking about erecting a union depot. They say "one fit to be seen in a town of this size." M. T.

PORTLAND, ORE.

There was a small contract let here for pier caps, to be built out of lava, a stone next to granite. The amount is \$480, delivered on the cars.

They are not yet ready to start cutting on the custom house material as the granite is not here yet and will not be for a couple of weeks.

A contract for an armory building was let the 15th inst. at Corvallis, Ore., to A. F. Peterson, of the same place, his bid being \$9,675; to be of Cascade granite in the basement.

MANSFIELD, O.

I beg to report the following building news Addition to Brunswick Hotel, Mansfield, Mrs. B. Wolff, owner. Hancock & Dow have the contract for completing the east wing of the Ohio State Reformatory and have commenced work on same; expect to employ about thirty stone-cutters. Kammacher, who had the contract for building wall to inclose grounds of Ohio State Reformatory, has notified the architects that he is unable to complete the job. What the state may do in this case is not known until Board of Managers meet.

The county commissioners of Richland county, Ohio, are going to build a stone bridge at Shelby, in place of the one which fell on the 4th of July killing and wounding many people.

The quarries in this vicinity report trade better. O'CONNOR.

EVANSVILLE, IND.

The building trade is still at a standstill.

Several miles of street pavements are under way—asphalt and brick. The wages paid—\$1 per day—caused a strike, but the workmen have resumed work at \$1.25 per day of ten hours.

The stone-cutters and other organized bodies of workmen have petitioned the mayor and city council asking that all further city contract work be paid the same the city pays its day labor—\$1.50 for eight hours—which has been adopted for the future.

The bids for the new waterworks opened last month was rejected as too high. Lowest bid

was about \$65,000. After making some changes in which stone has suffered, bids will be opened August 15; the estimate of the cut-stone work is about \$15,000. It would come in handy for stone-cutters, as they have had little or no work to do this season. In a general way building trade is dull, and no improvement expected this season.

A. L.

ST. LOUIS, MO.

The stone business here is none too brisk, yet there are quite a few jobs in progress. The object seems to be to substitute some other material. I believe stone is the item to be attacked where a reduction in cost of construction is required. There was a church let last week, and I am informed that Connery & Conroy, of this city are the successful parties for the cut-stone, which is to be Bedford. There is another large job to be let this week on Fourth street, which is to be of Carthage stone. STONE comes regularly, and I am very much interested in its contents.

GRACE.

MILWAUKEE, WIS.

I understand a resolution was adopted by the W. C. T. U. to erect a building to cost \$10,000. Gustav Pabst is also going to build a handsome residence; do not know exactly what the cost will be. I hear on good authority of several small jobs to be let in a short time in the surrounding cities. The following are a few jobs to go on in this city: There is a great deal of talk of an East Side high school to be built here very soon. Mr. Goll, of the firm Goll & Frank, is going to build a handsome residence. A Seventh Ward school is to be built to cost \$54,515, and to be completed by March 10, 1899; cost of stone \$2,478.

BREITKRENTZ.

BEDFORD, IND.

The Bedford Belt Railroad is cutting and setting stone on the boiler room and putting in the foundation for the machine shop.

All the quarries and mills are running.

The strike of the Chicago stone-cutters was a drawback to the stone industry of this city while it lasted, but the prospects are now favorable for increased trade. D. Y. Johnson, one of the mill operators here, is working on several good contracts for cut stone to be sent to Chicago, which otherwise would have gone there in the rough to other parties.

Messrs. Kerber & Co., cut-stone contractors, who have leased the Hallowell stone mill, which was idle for nearly three years, has the

same running. They have recently put to work a number of stone-cutters, who are under the superintendency of William Roberts, formerly of Bloomington.

EDGAR.

Earliest Strike on Record.

The earliest strike occurred about 1450, B. C., or upward of thirty-three centuries ago. Pharaoh was building a new temple of Thebes. The masons received very little cash, but a quantity of provisions, which the contractor thought sufficient, was handed to them on the first day of each month. Sufficient or not, they mostly ate it before the time had elapsed. On one occasion many of them had nothing left quite early in the month, so they marched to the contractor's house, before which they squatted and refused to budge until justice was done. The contractor persuaded them to lay their distress before the king, who was about to visit the works, and he gave them a handsome supply of corn, and so all went on well for that month. But the same state of things recurred by the middle of the next, and for some days the men struck work. Various conferences took place, but the men declined to do a stroke until they were given another supply of food. They declared the clerks cheated them, used false weights, and so forth, familiar enough complaints in this country under the truck system. The contractor not complying with their demands, they marched to the governor of the city to lay their grievances before him, and he tried to get them to return to work by smooth words, but that was no use, and they insisted on having food. At last, to get rid of them, he drew up an order for corn on the public granary, and the strike was at an end.

Ancient Marble Quarries.

The ancient marble quarries in Synnada are again being worked. The quarries are situate some 20 kilometers from Karahissar, and the marbles, called Phrygian, Mygdonians or Docimian, were in ancient Rome regarded as emblems of luxury and wealth. Many sorts are found, namely, white statuary marble of a remarkably fine grain; a transparent marble similar to onyx and also yellow, blue and gray marbles, all very fine.

SELECTED MISCELLANY.

"We'll Let It Go at That."



DICK wasn't no philosopher to brag about, I 'low, An' yet he had a sort o' knack, I can't tell what or how, O' kind o' sizin' up a thing in such an easy way As made you think he'd settled it an' settled it to stay. A little rude in speech at times but meanin' no offense, As near as I could figger out, to man or Providence. Time an' agin when things went wrong an' all his skies was dark,

I've heard him sort o' heave a sigh an' solenm like, remark,

"Oh, well! What t'ell?
God knows, I s'pose.
We'll let it go at that."

First he showed up in the camp, he didn't seem to care To talk with anybody, yet he always acted square Wasn't anything, we 'lowed, he cared to share with us, An' though he was onsociable we sort o' liked the cuss. But one dark night I found him kind o' lonesome at the store, An' got to chinnin' with him an' I liked him more an' more. Told me 'bout his gal back East he wanted for to wed, Who, I inferred, had jilted him, or, ennyway, he said,

"Oh, well! What t'ell?
God knows, I s'pose.
We'll let it go at that."

Knowned him better later on an' liked him better, too; Never met a man could talk the way he used to do, Always had a pleasant word for every one an' yet, Kind o' acted sorry, like his star o' hope had set. 'T wasn't hard to figger he had trouble on his mind, But him a actin' just as though he had to be resigned.

He took his bitter medicine in such a quiet way:

Didn't matter what occurred, he'd sort o' smile an' say,

"Oh, well! What t'ell?
God knows, I s'pose.
We'll let it go at that."

Kept a-workin' on until he struck it mighty rich, Just the very afternoon a letter come in which The gal back East informed him in a tender way that she'd Be mighty glad to marry him if he was still agreed. Sort o' turned his head, I guess, or ennyway, that night, At the mine a puttin' in a blast o' dynamite, Sprung it prematurely. Only lived a little while. Just before he went he said, an' with the same old smile,

"Oh, well! What t'ell?
God knows, I s'pose.
We'll let it go at that."

—Nixon Waterman, in L. A. W. Bulletin.

Relics of a Past Age.

A most remarkable discovery has been made on the farm of B. A. Prince, at Belpre, W. Va. A cave heretofore unknown to even the oldest inhabitant was found. The entrance will permit of one person going in at a time, and after proceeding ten or fifteen feet a large room is encountered, twenty feet square, of solid stone. Dates are carved in the walls as far back as 1598. In one corner of the room a stone door, swung on large steel hinges, leads to stone steps, which led the explorers to a room ten feet below the first room, which contains human skeletons in endless numbers. By the aid of rocks and a rope one can be lowered to another room, twenty feet below the last mentioned room, in which is to be found fish by the hundred in a pond, the fish resembling the common perch. Hundreds of perfect stone fish are to be found on the floors of the two first-mentioned rooms, with dates carved upon them as far back as 1598. The people are car-

rying the odd specimens away for relics.—Unidentified Liar.

Concerning Counterfeit Marble Work.

Nothing will run a thing out of vogue so quickly as the placing on the market of cheap and tawdry examples of it. Marble columns are yet very expensive. Moreover imported marbles, under the existing tariff, are much more costly than they were a year ago, when the Wilson tariff was in force.

With the miserably poor imitation marble mantel came the downfall of the marble mantel itself. Not that the marbleized slate thing half the time looked enough like the real article to libel it. Only that the plain, ungraceful marble shelf was not of itself beautiful, and to decorate it with carvings and polish it to a tombstone finish, cost a quantity of cash. And so it came about that the mantel of hard wood pushed the mantel of marble out of vogue and fashion.

If we thought we had rid ourselves of imitation marble as an important factor in building embellishment, we were only deceiving ourselves. What is known as the "scagliola business" has grown up in the land into the proportions of a full-fledged industry, and in our large cities you can summon to your office at twenty-four hours' notice a suave gentleman who will blandly offer to duplicate in "scagliola," or counterfeit marble, a row of columns which would cost a small fortune if done in marble.

He will smoothly unfold to you the beauties of his art as seen from across the footlights of the completed job. He will descant about the immense value of certain Italian and other foreign marbles and then cooingly offer to furnish counterfeits thereof so like the real thing that "they could not be told from the genuine by an expert at five paces," the job to be done completely at one-third the cost of the real stuff.

Is counterfeit marble largely in use these days? We should reply most emphatically in the affirmative. The contractors for real marble do not feel the loss of the business which goes to the maker of "scagliola" for the simple reason that this class of trade has never been theirs and would never become theirs under present conditions. When a big structure is written up upon completion you never hear of the "scagliola" stuff within—for obvious rea-

sons. It is only useful and desirable so long as it passes for the real thing.

Some of this counterfeit marble is wonderfully like the real thing. Some of the very best of it is made in New York, and although it is not as durable as the real marble, it is guaranteed in many cases to outlast the remainder of the building in which it is placed.

But it is the inferior "scagliola" which we should be on our guard against. Small cracks appear on a great deal of it after it has been up only a few months, and some very fine interiors have thus been marred seriously. This has occurred upon work where thousands of dollars have been expended.

As at present made, about 65 per cent. of it is inferior and worthless. At present there is a taste for planning and embellishing interiors in classic style and "scagliola" lends itself very aptly for this purpose. There is reason to fear therefore that a "scagliola" epidemic may break out in the land at any time, and we should devise some means of controlling it before it assumes a too virulent form. This would exercise a most beneficent influence as to its quality and in protecting the makers of the best grades of it.

That its popularity is increasing with rapidity there is no doubt whatever. It forms a part of the plastic relief furore which is now taking city, town and hamlet by storm. We hope that the reputable manufacturers will lose no time in protecting themselves from the irresponsible and unscrupulous hangers-on.—American Contractor.

United States Sea Coast Artillery.

The various methods of mounting and protecting heavy ordnance can perhaps be best defined by referring to the nomenclature which the U. S. War Department has adopted for its carriages. The barbette, sometimes called non-disappearing, and the casemate, often described as the minimum port, carriages depend upon the strength of the barbette or casemate for the protection of the guns and carriages, and it must not be forgotten that these systems protect only those portions of the guns that are within the barbette or casemate ports, and afford most excellent targets, susceptible to accurate machine gun attack.

Most of the heavy coast defense guns are mounted on disappearing carriages of the grasshopper or Moncrieff type, modified and

known in the United States as the Buffington-Crozier carriage. They are adapted to limited or all-around fire, in accordance with the emplacement.

The mortars are mounted on hydraulic spring-return carriages, but depend for their invisibility upon their position, which should be behind natural or artificial elevations, made to harmonize with the surrounding country. They are in absolute security, their crews are under cover, they are fired from firing stations long distances away, and if smokeless powder is used their location can be defined only with great difficulty.

Mortar batteries are acknowledged to be one of the most important factors in the defense of harbors and positions of vantage, and practice with them has reached such a high standard of proficiency that no fleet would dare attempt the advantages of greater accuracy that an anchorage would secure over the attack of a fort while under way. The destructive effect of the vertical fire of a 12-inch shell upon the thin deck of a ship can be readily imagined.

In addition to the batteries of 8-inch, 10-inch and 12-inch guns, mounted on gun lifts and disappearing carriages, the principal American seaport of each coast is additionally protected by a gun battery and plant of novel character, the pneumatic dynamite gun, the efficiency of which, like the submarine torpedo-boat, remains to be tested.

At Sandy Hook, New Jersey, and at Fort Winfield Scott, California, there have been erected groups of three 15-inch pneumatic dynamite guns, of 40 calibres length, to fire projectiles adapted to charges varying from 500 to 100 pounds of explosive gelatine, with ranges, respectively, of 2,000 to 5,000 yards.—Capt. W. H. Jaques, in *Cassier's Magazine* for August.

Trade Marks for Chinese Business.

To the "foreign devil" who would cater to the Chinese trade it is of the first importance almost to study well the matter of trade-marks, for upon the circumspection with which these are chosen will depend largely the fate of the goods. Mr. Samuel L. Gracey, United States Consul at Fuchan, in one of his recent reports, gives a list of some of the pictures most frequently seen, and which, therefore, presumably are popular and would lend themselves well to trade-mark use. But simply naming these things does not supply sufficient data

from which to prepare them. It must be remembered, so Mr. Gracey tells us, that Chinese art is very peculiar, and a tiger, as ordinarily represented by foreign artists, would not meet with favor with John Chinaman. It must be a tiger according to Chinese imagination and art, of unreasonable length of body or bigness of head or curve of tail, and in impossible attitudes. On a popular Chinese match box is displayed a monkey standing on its front feet, head nearly touching the ground, with hind feet in the air, and tail whipping the skies. The grotesque and even hideous, to European and American minds, tickles the fancy of the dwellers in Far Cathay. No description can supply adequate information to an engraver or colorer by which he could produce the real thing, and any departure from the Chinese fancy in such things would brand the goods at once as foreign product and doom it to defeat.

A Chinese dragon differs from a Japanese dragon in its contortions. A royal dragon must have five claws, while the plebeian beast has only four. A stork must always stand on one leg, or, flying, must present an enormous spread of wings and trailing long legs. All Japanese birds, when flying, must have a tendency downward, never up or on a straight course. To a Japanese, nothing is preferable to the representation of snow-capped, sacred Fusi-yama, as seen on nearly all Japanese fans, screens, and other articles. One of the labels mentioned by Consul Gracey represents a woman in bright robes, holding a long-necked vase on her shoulder, while at her side is a monkey holding a chrysanthemum in its mouth. Others are equally grotesque. But they all are suggestive of the curious fancies of those of the Celestial Empire.—From *Cassier's Magazine* for August.

Labor and Capital in the Slate Industry.

One of the favorable indications of the stability of the slate industry is the comparative absence of labor troubles and complications between the employer and the employed, and the absence of suffering and distress on the part of the laboring classes in the slate regions.

It is a fact beyond dispute and the truth can readily be demonstrated by observation, that the laboring classes are better paid and cared for, better housed, fed and clothed, enjoy greater liberty and more comforts than any

other class of working people in any similar line of employment.

While it is a fact that the exceptional high wages paid in certain lines of manufacturing and trade in which a higher order of training and skill is required, are scarcely to be found at all among slate workers, it is equally true that low, degrading, starvation wages, so common in many other industries, are equally rare, or altogether unknown. While these extremes are wanting, the mean averages very high and the result is a class of intelligent and independent citizens, who fully enjoy the benefits and advantages of their position. Nor are they over-worked. Ten hours per day during the summer season and eight or nine hours per day during the cold winter months, constitutes a day's labor, with the Saturday afternoon half holiday throughout the entire year. The ordinary unskilled laborers, of whom nearly one-half are foreigners, earn from \$1.00 to \$1.40 per day of ten hours, while the quarry laborer of some experience and skill will earn from \$1.40 to \$2.00 per day. The slate makers and quarry men, classed as mechanics, are composed largely of Welsh and Cornish men, earn from \$2.00 to \$2.50 per day, and quarry foremen from \$2.50 to \$3.50 per day. Firemen and engineers are generally engaged by the month and average from \$40.00 to \$70.00 per month, and quarry superintendents from \$75 to \$100 per month.

With few isolated exceptions, wages are paid promptly and in an entirely satisfactory manner to the wage-earner. Attempts to interfere with the full right to receive and dispose of his earnings are seldom heard of. The much discussed "Company Store" oppression is a phantom in the slate districts, which cheap politicians and third-rate newspapers create for the purpose of gaining cheap notoriety, or the pettifogger of a lawyer now and then calls up for the same purpose, when he can induce some disgruntled employe to make complaint and pay a small fee. In the majority of cases the employer's store, connected with the slate industry, is a privilege to the employe, a positive advantage and benefit to his family without infringing upon any of his rights, or liberties, and with rare exceptions the utmost cordiality and harmony prevail between the employer and employed—not the enforced harmony of master and slave, of the oppressor and oppressed, but the harmony of freedom and equality of each in his own rights and place.

This immunity from antagonism and conflict between the interests of labor and of capital, is the result of the employer's willingness to share with the employed in a liberal proportion the fruits of their combined effort.—Slate.

Old Mexican Monuments.

Within an hour's ride of the City of Mexico the traveler can reach one of the many ancient ruins that dot this country, and whose history was as mysterious when Cortez landed as it is now. The pyramids of the sun and the moon are near the little city of San Juan Teotihuacan on the line of the Mexican railway. From the evidences that are to be found about these ancient monuments they once stood in the midst of an extensive city, extending at least several miles from them in every direction. Viewed from the railroad the pyramids do not appear very formidable, because the eye compares their height with that of the small mountain, Cerro Gordo, nearby. Janvier gives the following detailed information about these evidences of a prehistoric civilization:

The pyramids of the sun, according to the very careful measurements of Senor Gracia Cubas, is 216 feet 8 inches high, with a base 761 feet by 721 feet 7 inches. The platform on the top is 59 feet from north to south by 105 feet from east to west. The pyramid of the moon is 150 feet 11 inches high, with a base 511 feet by 426 feet 5 inches, and a crowning platform 19 feet 8 inches square. The only entrance as yet discovered is found on the southern face of the pyramid of the moon at a height of sixty-five feet from the ground. This gives inlet to a narrow descending gallery, interrupted by a deep square well, the walls of which are laid up with carefully squared stone. The axis of this gallery (observation of Senor Gracia Cubas) coincides exactly with the magnetic meridian. Beyond the gallery the interior remains unexplored. The pyramid of the sun has not yet been entered at all. To the south of the pyramid of the sun is a large earthwork known as the *ciudadela* (citadel), a square inclosed by a mound averaging 262 feet thick by thirty-two feet high. In the center of the inclosed square is a small pyramid, and upon the inclosing earthworks are fourteen small pyramids disposed at regular intervals.

In the neighborhood of the pyramids are great numbers of tumuli, isolated and grouped. The most notable group of tumuli

s that which borders the so-called calle de los muertos (the Street of the Dead). The curious causeway begins near the citadel, and, passing the western face of the pyramid of the sun, ends at the southern front of the pyramid of the moon, there widening out into a large circle, in the center of which is a tumulus. Many of the tumuli have been opened, disclosing in some cases boxes of wrought stone inclosing a skull and ornaments of obsidian and pottery; in other cases (in the tumuli along the sides of the Street of the Dead), only empty chambers have been found.

The conclusion arrived at by Senor Orozcoy Berra in regard to these very curious remains, mainly based upon the wide divergence from any known types of the clay masks found in what may be assumed to be the older of the tombs, is that they are the works of a race older than either Toltecs or Acolhuas, of which only these monuments now remain.—Modern Mexico.

Early English Masonry.

The ancients could not draw stones of any size from the quarries. They made good use of the small broken bits of stone they could dig out, but our mechanical advantages enable us, with larger blocks, to adopt a more perfect kind of masonry. There is no doubt that some of the finest buildings of antiquity are constructed of stones of immense size. The Pantheon may be quoted, and every one will remember the huge blocks that must have been quarried for monolith columns. The general decline of art shows itself in this respect, perhaps, as well as others. There is a great gap between such a building as the Porta Nigra, of Trèves, and the best of early Romanesque masonry. Art in all its branches was, it seems, almost to die, in order perhaps that Christian art might be less a development than a new creation. The Pharos in Dover Castle is a fine specimen of Roman excellence. Its builders could not get hewn stone, but they so bound their flint rubble with bands of brick that the tower stands like a rock.

Close by in the church is a good deal of undoubted British masonry in its shell. Here, too, there is "Roman brick" in the quoins, etc; but the general inferiority of the masonry to the real Roman work is very striking. Then again the fine Romanesque ashlar in the chapel of the Norman is a specimen of the reviving art

of masonry. The stones are all small, though beautifully and effectively used. There is no single stone to tempt you to measure its length and width, and to exclaim at its bulk, which seems to be the general effect produced on people's minds by modern masonry. As a matter of fact, it must, we suppose, be granted that the architects of the Romanesque and Early Pointed styles could not procure large stones. They were compelled to use even fine building stone, like that (which they so highly valued) of Normandy, in small masses, as they could inartificially obtain it from the quarries. So late as 1841 there was not a single crane at Caen by which to lift the stone had it been extracted in very large blocks—a fact that may assist us to comprehend the great mechanical disadvantages under which the Mediæval architects labored. But though their stone was in such small pieces, how beautifully they used it. Of course there is a great deal of ancient work that is very bad, although what has stood for six or seven centuries may seem fairly entitled to entire exemption from any blame. But as a general rule early masonry—at least after the later Romanesque had superseded the Anglo Saxon kind—is surprisingly excellent, not only for solidity but for keeping and harmony. It suits the style. The eye is satisfied entirely, without knowing or inquiring why. You admire the design and feel almost unconsciously that it is worthily embodied in its material exhibition. You are neither induced to examine and commend the ingenuity with which the difficulties of a bad building stone are overcome, nor are you called on to join in the vulgar admiration of "such big blocks." In a word, you forget such detail in the whole; but when you can descend from the whole into particulars, you find them all that can be wished.—Illustrated Carpenter and Builder.

Losses Through Bad Roads.

General Ray Stone, the apostle of good roads, estimates that the farmers of the United States in marketing the produce of their farms, haul 500,000,000 tons of freight yearly over 1,500,000,000 miles of public roads, and that the loss because of the difficulty of transportation is not less than \$600,000,000 per year, which would pay the interest at 3 per cent. upon the outlay of money sufficient to rebuild all the bad roads and maintain them in proper repair afterward.

BOOKS AND PERIODICALS.

"THE COFFER-DAM PROCESS FOR PIERS, Practical Examples from Actual Work," by Charles Evan Fowler, C. E.; 8-vo., cloth. 15 chapters, 158 pages. Price, \$2.50. New York. John Wiley & Sons.

This is a reprint in book form of an interesting series of articles recently concluded in *STONE*. Any reader who has followed the series will concede the intensely interesting character of the treatise of a most important subject of practical engineering. There is not an over-abundance of literature extant treating on the subject of the proper construction of the preliminary work in bridge building, and this book will be welcome as the latest and a most popular contribution.

The American Monthly Review of Reviews for August reviews the Santiago campaign by land and sea from start to finish. Winston Churchill, who wrote so acceptably on Admiral Dewey for the June Review, describes in this number the wonderful battle with Cervera's fleet, and his article is illustrated in part from Hemment's remarkable photographs of the Spanish ships taken the day after the fight. John A. Church, formerly of the Army and Navy Journal, contributes a full account of the Santiago land fighting, and his article also is illustrated from new photographs. Park Benjamin writes on the work cut out for the Eastern squadron under Commodore Watson. Altogether, the Review again shows its ability to keep well abreast of all important military and naval movements, and to exhibit a clean pair of heels to all its competitors in magazinedom.

The complete novel in the August issue of Lippincott's, "The Last Rebel," is by Joseph A. Altsheler, now well known as a writer of war stories. The scene is a lonesome post in the southern Alleghanies, held for the Confederacy by a chivalrous monomaniac after the unpleasantness of 1861-65 had ended. The action deals with the experiences of a northerner who unadvisedly wandered into those parts and found himself a prisoner. The prospects of "The United States as a Colonial Power" are considered by Fred Perry Powers. He thinks that this is our manifest destiny, and that by reforming our politics and putting only fit men in office we can discharge our new duties creditably. George J. Varney writes of "Signaling in War-time," and George Ethel-

bert Walsh of "Privateers." Two articles appropriate to the season are "Death in the Woods and Fields," by Calvin Dill Wilson, and "Summer Logging," by Allan Hendricks; each is the outcome of personal observation and knowledge.

"The Blight of Free Trade—The Blessings of Protection," is the title of a document just issued by the American Protective Tariff League. This document clearly demonstrates the effect of the system of free trade under the Wilson tariff, and of protection under the Dingley tariff. It is based on the result of the Tariff League's Industrial Census, and should be in the hands of every voter. Seven copies to any address for six cents. Address W. F. Wakeman, General Secretary, No. 135 West 23d street, New York.

The extremely important question of the education of women for domestic life is discussed by Mary Roberts Smith in Appleton's Popular Science Monthly for August. Mrs. Smith shows that a special training is just as desirable and as necessary to efficiency in domestic life as it is in any of the other professions. An interesting geological study, by Prof. I. C. Russell, appears in same number, under the title "Topographic Features Due to Landslides"; also Dr. Collier's second article on the "Evolution of Colonies," takes up the question of emigration. He shows that emigration is at first exclusively, and to the last predominantly, masculine in all its aspects, and that it is primarily conducted by the heroic strand of humanity, the manlier races and their most vigorous sections. "The Manual Training School" is the subject of Professor Henderson's third chapter. "Some Uses of the Camera in Zoölogy" is the title of an attractively illustrated article by Dr. R. W. Shufeldt. Mr. Wells' nineteenth chapter is entitled "What Should Be Taxed, and How It Should Be Taxed." In view of the recent large increase of taxation, this subject should be one of extreme interest to all taxpayers, and Mr. Wells, by virtue of his close connection with the problems in taxation ever since his service in President Lincoln's tax commission, is probably better fitted than any other economist in the country to discuss these questions.

MACHINERY AND SUPPLIES.

[Matter appearing under this head is compiled and edited from data furnished by the advertiser, and should not be accepted as the opinion of the publishers.]

A Perfect Drill Clamp.

Since the first advent of channelling machines, there has been no improvement on them of more importance to quarry owners than the one herein described. This clamp has been thoroughly tested during the past year, and has given such perfect satisfaction, that it has been adopted in all quarries where tried.

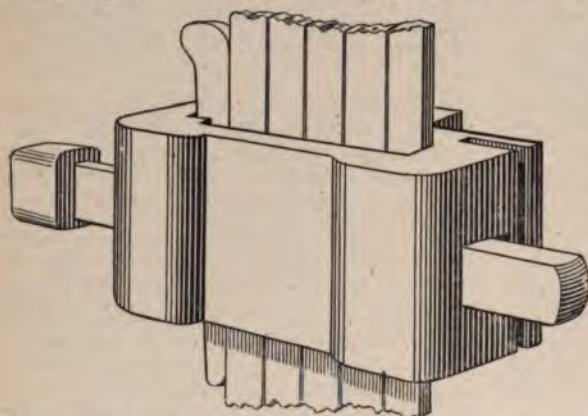
The enormous strain on a drill clamp when in use is such that it has been found impossible to keep the old style clamp in condition for use without repairs almost every day, and often several times a day. The loss of time while repairs are being made, generally involves the time of five men, so that the expense for repairs is very considerable during a season's work, besides the loss of output of stone. The manufacturers claim that this clamp may be used almost indefinitely without

more effective in holding drills than a movable cap, with its constantly breaking stud bolts, and that the drills can be loosed or tightened in half the time required with the old style clamp. The keys are made of hard cast steel, the cross key being accurately planed to a fixed taper, that is standard in all the clamps, so that a perfect bearing on all the drills is insured. A movable cap is provided for small end of cross key to prevent injury in loosening key. The simplicity and perfection of this clamp can not be fully appreciated without seeing it in use.

A remark often made by those using this clamp is, "there are no stud bolts to break, or nuts to get loose, and the drills—they never slip." All of which is strictly true. The expense and trouble of providing corrugated top ends for the drills is entirely unnecessary when this clamp is used, as it holds the drills perfectly without them, and in fact is often used in making deep cuts without the use of a top clamp at all.

It may reasonably be claimed, that with this clamp, from 10 to 20 per cent more stone can be cut in a month's run than with the old style clamp in the condition they are usually in after a few months use, for the reason that no time is lost in making repairs, and the drills do not slip, no matter how hard a blow they are striking. The inventor, and those who have assisted in perfecting this clamp, are all practical men in quarry work, who know all the defects of the old style clamp, and what is required to make a better and entirely satisfactory one. How completely they have succeeded can only be fully understood when the clamps are seen in use.

We sell these clamps on their merits, and will furnish responsible parties samples, subject to approval after ten days' trial. For further information desired, address Seward & Co., Bloomington, Ind.



any repairs, and that the money saved in repair account, and the increased output of stone will pay for a set of these clamps in a short time.

As will be seen from the cut, this clamp is made in one piece, opening for drills being large enough to admit them when keys are removed. The steel of which this clamp is made is warranted to stand a tensile strain of over 60,000 pounds to the square inch, so that it is not possible to break it by any strain it can have while in use. The drills are held by two keys, a vertical key, as in other clamps only much larger, and a cross key of large size. The improvement consists in providing a clamp with a movable cap, so that stud bolts are not needed, having a cross key to hold the drills, in place of a movable cap. It has been found in practice that the cross key is much

The new air compressor catalogue No. 32, from the Ingersoll-Sergeant Drill Co., describes and illustrates fully the air compressing product of this immense concern. The catalogue is a compendium of all that is recent relating to the machinery and methods of this new power, which is making such remarkable progress in the industrial world. Address main office at New York city, or any of the numerous branches given in their ad. in this issue.

NOTES FROM QUARRY AND SHOP.

The crops of the Avondale (Pa.) Marble Co. have been seized by Martin Meloney for taxes.

The residents in the neighborhood of Thirteenth avenue and Fourth street NE, Minneapolis, Minn., are greatly incensed over the presence of a stone crusher in that locality. The machine is very noisy and creates a dust that is almost unbearable, and the people have taken the matter into the courts to see if the company cannot be compelled to remove the nuisance.

Tarrytown, N. Y.—The local dressed stone dealers are much displeased with John D. Rockefeller. It is well known that Mr. Rockefeller deals heavily in oil, but now he comes to the front as a dealer in dressed stone. The village of North Tarrytown has been expending a considerable sum this year in improving its streets. The local dealers have until lately been supplying the stone at \$1.30 per ton. Mr. Rockefeller has a stone crusher on his place, with which he crushes all the stone used on his roads, which are conceded to be the finest in Westchester county. He has about 300 tons of this road dressing on hand, and he has offered to sell it to this village for fifty cents a ton, thus underbidding the other dealers. The village has accepted his offer, and are now using his dressing. The other dealers, being unable to compete with him, are left out in the cold.

The largest scale ever known to fall in any of the quarries here, fell in the old Ripley quarry, says the Rutland, Vt., Herald. The scale fell in under the old bridge. It is about 40 feet square and 10 feet thick. It is estimated to weigh about 150 tons. It fell only about 20 feet and was not broken in the fall. There are seven layers of marble in the piece. No one has worked in this quarry for some time.

West Brookfield, Mass.—The large granite monument, weighing 8,000 pounds, which has been on the car at the depot since April, being refused by the consignee, has been ordered to Boston to be dumped in the Back bay.

Le Roy, N. Y.—G. K. Morris, representing the firm of A. G. Morris & Co., of Bethlehem, Pa., is in Le Roy, making arrangements for the locating of a stone crushing plant. The site of the plant will probably be about a mile east of the Lehigh Valley station at North Le Roy. The plant will be operated by this firm, under contract with the Lehigh Valley railroad, to

furnish a large amount of crushed stone for ballasting purposes. It is estimated that the cost of ballasting the road as proposed will be nearly \$800,000, and it will require, at least, six years to finish the contract. A plant will be erected at Bethlehem, Pa., which will supply the stone for the eastern section of the road, and the Le Roy plant will supply the western section. The crusher which will be placed in position will weigh 80,000 pounds, and will be operated by a 125-horse power boiler and engine. The capacity of the crusher will be twenty-five carloads of stone a day, each car holding nearly thirty yards of stone. A switch from the main line of the Lehigh Valley to the crusher will be built. The plant will be superintended by George B. Finnigan, of Wilkes-barre, Pa. The plant will be ready for operation in about a month.

The Dubuque, Iowa, Monument Company had a strange caller the other day, and one whose picture would look in place in hell's half acre, says the Dubuque Globe Journal. He is a twice married man and offered to sell the monument on his first wife's grave for \$100. It is of granite and originally cost \$300. The man to whom he made the proposition was stunned with the offer and inquired the reason for selling. "Oh, the monument ain't doing her any good and I want the money," was the reply. The monument man, leading the other on, offered \$50 for the stone. "I want \$100, but if you won't give it, I'll ask my wife and see if she's willing to sell it for \$50, if so you can have it for that." The fellow went away and came back with an agreement to sell for \$50. The monument man had tolerated his visitor long enough so he helped him out the door.

There are 1,600 men in the employ of the Vermont Marble Co., Proctor, Vt., and the pay roll for June was \$50,000; average wages per capita, per month, \$31.22.

The Warner Granite Co., Washington, Vt., has recently equipped its plant with pneumatic tools.

At a foreign quarryman's wedding near Bridgeport, Pa., the soft drink bill amounted to \$65.

Coleman Crabtree and Joseph H. West have gone into partnership at Swan's Island, and will run the quarry at Mackerel Cove, Me.

Trade continues fair in Hallowell, Me., at present.

The largest blast ever known at Beloit, Wis., stone quarries took place Aug. 4, when 600 cords of stone were dislodged by the explosion of 200 pounds of powder. Hundreds of people witnessed the explosion.

The Amberg Granite Company, whose works are at Amberg, Wis., are running with a full crew, have two good-sized jobs, one for the state reformatory at Green Bay, and one for the state bank at Kiel. The town is unusually lively, as a good many stone-cutters from outside are going there to work at good wages.

Chattanooga (Tenn.) stone-cutters adopted the eight-hour day without stoppage of work.

Near Briancon is the Alpine glacier du Casset, which is now being regularly worked as an ice quarry, the product being shipped by rail to Paris. The ice vein is about 100 feet wide and 25 feet thick, and it is found that it can be worked at a profit, making the first commercial use of the glacier so far known.

The completion of the new 'Frisco railway from Oklahoma City to Sapulpa, Okla., will open up valuable rock quarries.

Avondale, Pa.—The Avondale lime Company have struck a vein of very fine marble in their quarries near this place.

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Advertisements inserted in this department for 15 cents per line each insertion.

MARBLE PROPERTY—Undeveloped. Fine gray and blue marble. Ideal water front and shipping point, mouth of Soo river on the great steamboat channel, 40 miles northeast of Mackinaw. Low freight, cheaply quarried. Rock bare, rising nicely from water's edge. Will give you a bargain on sale, lease or royalty. Your correspondence and investigation invited. W. B. HOUSE, De Tour, Mich.

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FOR SALE—By order of Court. Complete brick making plant of W. C. Hill Estate now running at good profit, nineteen acres of land, one mile from postoffice, Seattle, Washington. Price, \$30,000. WILLIAM H. LEWIS, Administrator, P. O. Box 52, Seattle, Wash.

FOR SALE—Blue Stone Quarry, located Summit, N. Y., 37 acres; also steam drill in good condition, separate or together; price low. For particulars address T. H. MACGILL, Troy, N. Y.

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Advertisements under this heading 10 cents per line each insertion.

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WANTED SITUATION—Cut stone foreman desires position. Is capable of taking charge of all kinds of stone-cutting machinery. Have had 16 years' experience in cut stone business. Can give references from last employer, who has retired from business. Address FOREMAN, care of STONE.

SITUATION WANTED—By first class man as foreman or draughtsman on cut stone work. Has had large experience; can give A1 references; sober. Address P. A. J., care of STONE.

WANTED—Position; 16 year-' experience as foreman and superintendent in general contract work, quarries and heavy masonry; expert on broken ashlar work. First-class references furnished. Address J. B. GORDON, Roscoe, New York.

WANTED—Situation as Superintendent or Manager quarrying and cutting stone, or either. Best references. Understand all details of the work; can read plans and handle men. CHAS. A. APPEL, Box 5 A, Middletown Conn.

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Industries located on the line of The Belt Railway Co. of Chicago are afforded unequalled switching facilities and the advantage of connecting with all Chicago railroads. They have the benefit of competitive rates and an abundant supply of cars for shipments at all times. Parties contemplating the establishment of industries in the vicinity of Chicago are invited to communicate with the undersigned, who will promptly furnish full information in regard to locations switching rates, car supply, etc. B. Thomas, P. & G. Mgr., Dearborn Station, Chicago.

*Mr. Thomas A. Edison
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(WRITE FOR CIRCULAR.)

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The Pohlé Air Lift Pump.

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HAVEMEYER BUILDING, N. Y.

New York, N. Y.—An attachment against John Beattie, granite quarryman at Leet's Island, Conn., for \$9,244 in favor of the Booth Brothers & Hurricane Isle Granite Company, balance due for granite blocks. It was obtained on the ground of non-residence. The attachment was served on a third party here. Some years ago Mr. Beattie had a contract on the Bartholdi Statue.

Avondale, Pa.—Avondale Marble Company, reported to have given judgment for \$3,101.

Philadelphia, Pa.—Edward Rooney, artificial stone pavements, reported to have given judgment for \$205.

Baltimore, Md.—Joseph Breunig, marble, reported to have given judgment for \$95.

Philadelphia, Pa.—Samuel G. Harvey, Jr., marble worker, reported to have given judgment for \$128.

San Antonio, Tex.—Otto Zarkel, reported to have been sued for \$154.

San Antonio, Tex.—Charles Mierow, marble and granite, real estate advertised at sheriff's sale.

William Morgan, Slatington, Pa. For the past ten years was manager of the Royal Slate company's works at Windgap. His widow, one daughter and six sons survive.

Plymouth, Wis.—W. H. Herbert & Co., of Chicago, have rented the old Peerless chair factory plant of Mrs. H. C. Laack, which they will use as a factory for the manufacture of cement for drives, walks, cellar bottoms, etc., as well as cut stone and artificial building material for various uses.

The real estate formerly the property of the Skowhegan Slate Company, at East Madison, Me., has been sold. Being off the railroad, with competition from other quarries, was the cause of the failure of this property paying. The present parties interested intend to organize a company and work a team to Blanchard on the line of the Bangor and Aroostock railroad, and will probably send most of their machinery there from East Madison.

Pittsburgh, Pa.—The Clinton Cement Company will erect two steel frame buildings for the manufacture of cement, to cost \$10,000.

Carthage, Mo.—The old kilns of the Hubb, or White Star, lime works and the old Myers lime works, have been united under the management of the Ash Grove Western Lime Association.

Bangor, Mich.—The Bangor Marble Works is selling stock of marble and granite at cost; works are to be moved to Coloma, Mich.

The stockholders of the North Bangor (Pa.) Slate Company held their annual meeting

and elected the following directors: Elkanah Drake, F. A. Wilkinson, Benjamin Atha and F. C. Day, all of Newark, and Dr. D. H. Keller, of Bangor. Subsequently Mr. Drake was elected president and treasurer, Mr. Wilkinson was elected secretary and Messrs. Atha, Day and Keller were elected an executive committee.

The new office of the Bronson Portland Cement company, which was at Cleveland, Ohio, has recently been removed to Bronson, Mich. Hereafter all business, contracts etc., will be made at Bronson.

St. Joseph, Mo.—Charles Bremer has purchased 80 feet of ground at Fifth and Walnut streets to be used as a stone yard.

A fine vein of marble has been discovered in the Lane Company's quarries, at Avondale, Chester county, Pa.

Syracuse, N. Y.—The John Nevins stone quarry west of the city has been sold to the Skillings, Whitney & Barnes lumber company. The purchase includes 16 acres of land and the dock. Consideration said to be \$4,000.

H. M. Clark, of the firm of Boone & Clark, marble workers, at Clinton, Ill., has closed out his interest in the firm, and will remove to Petersburg, Ind.

Barre, Vt.—J. B. Davidson has sold his interest in the North Barre Granite company to A. G. Arche, L. Batista and Alexander Duncan.

Dayton, O.—Boots, Bickett & Conklin, of Xenia, have purchased the stone yards and all the belongings thereto of the Huffman estate.

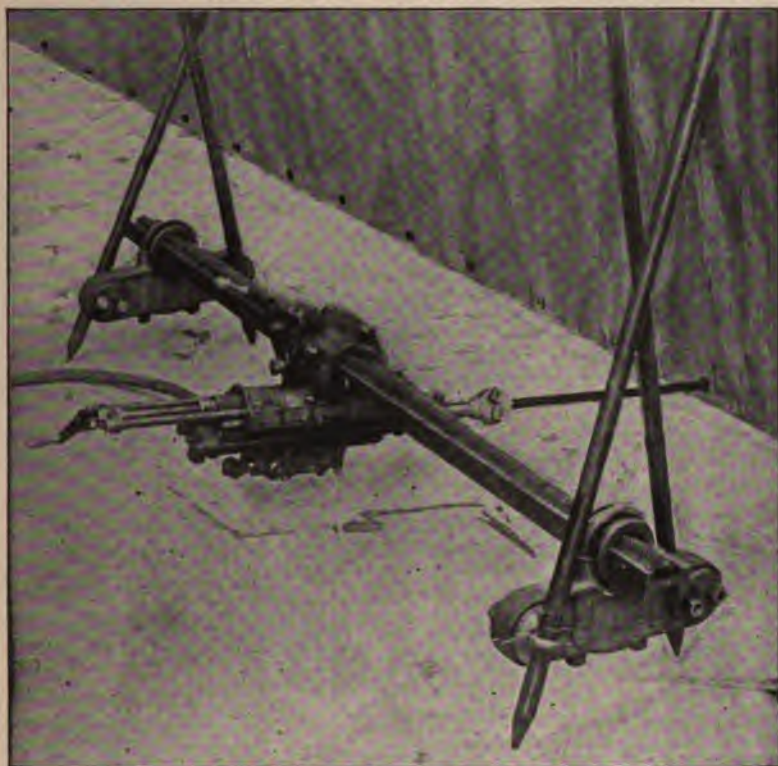
Spokane, Wash.—At the annual meeting of the stockholders of the United States Marble Company held July 9, the following trustees were elected: Judge C. S. Edwards, of Chicago; Mrs. C. L. Glasner, of Chicago; John Kinan and D. D. McPhee, of Spokane, and T. H. Greenway, of Valley, Wash.

At the Bronson (Mich.) cement factory lately a lot of workmen quit. They get 10 to 12½ cents an hour, and the dust in which they have to work is detrimental to comfort as well as to health. They are obliged to wear a sponge protector over the nose and to keep the mouth shut while at work. Of course none of the Bronson girls could stand that for an hour. Think of a woman being compelled to keep her mouth shut any length of time. The men declare that they won't let their nostrils be Portland cement bags for a dollar a day, and if McKinley's prosperity car can't get any nearer the factory than that, they will take chances at some other work, and dine on grindstones. Cement is too hard for them.

The Casey and Sherwood quarries at Stonington, Me., have been re-opened.

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Logansport, Ind.—Harry A. Barnes and C. B. Billman will engage as partners in the marble and granite business.

A valuable marble, said to be of the Egyptian type, has been discovered near Thompson Falls, in Missoula county, Montana. The stone is dark, with white and yellow streaks. It is capable of very high polish. A Mr. Beals, who has had thirty years' experience with stone and marble in Oregon, Washington, Idaho and Montana, pronounces the Thompson Falls specimen the best yet discovered in the Northwest. He finds it remarkably free from checks and flaws, and says it can be placed on the market at a less cost than granite.

The Philadelphia Record says that according to the latest bids for contracts on asphalt paving in that city the work can be done at a profit for \$1.20 per square yard, or about one-half of the charge three years ago. Similarly, bids were received for laying vitrified brick pavement at \$1.35 per square yard.

Beaver, Pa.—A. F. Smith & Co. have taken a couple of stones from their quarry, each weighing ten tons. The stones are said to be the largest ever taken from a Beaver county quarry. They are perfect, not even having a dark streak running through them. They are intended for Schelney Park, Pittsburg.

A block of slate was recently taken out at the Grand Central Slate Company's quarry at Pen Argyl, Pa., which in size and amount of blackboards it produced exceeds any single block ever quarried in that section. The block measured 7 feet in length and 7 feet in width and was 14 inches thick. From it were made 73 blackboards, each 3 by 6 feet and 6 inches, aggregating 1,300 feet.

A marble block has just been unearthed at Corinth, Greece, on which is a mutilated inscription, only the equivalent Greek letters agogehebr being left. It is supposed that these letters are a portion of the two words, "Synagoge Hebraion," which mean in English "Synagogue of Hebrews," and that the stone may have been a part of the very synagogue in which the Apostle Paul, when in Corinth, "reasoned every Sabbath and persuaded the Jews and Greeks."

Montpelier, Vt.—At the annual meeting of the directors of the Wetmore & Morse Granite Company, a dividend of five per cent. was declared on the earnings of the past year, to be payable August 2. The annual meeting of the stockholders will be held July 19.

Berlin, Wis.—George Knowles, former superintendent of the Berlin & Montello Granite Company, dropped dead on the lawn at his residence July 13. The cause of death was apoplexy.

Brattleboro, Vt.—Ward & Douglass have leased the Marshall quarry in Dummerston.

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Chicago.—William H. Burke, who did the marble and mosaic work in the Columbus Memorial Building, was given a decision against the Columbus Safe Deposit Company. A lower court had awarded him \$33,000. Burke took the contract for \$120,000, but because of delays the company set up a loss of \$33,000 in rentals, and held out that sum. Burke contended that delays were due solely to alterations in the architect's designs.

Richmond, Va.—Vaden & Coutts, stone works, have dissolved partnership.

The South Bend, Ind., Cement company has been reorganized with outside capital and work will soon begin at the factory. The officers are as follows: President: Mr. John Lux, of Logansport, Ind.; vice-president, Mr. C. H. Atkinson, of Cedar Falls, Iowa; secretary and manager, Mr. Amon Moore, of Bellefontaine, O., and superintendent, Mr. Lee W. Atkinson, who is also an Ohio man.

The Blue Valley Slate Co., Slatington, Pa., re-elected Thomas Johnson, Frank D. Bittner, James F. Hunsicker, L. H. Yaeger, Reuben Helfrich, R. F. Muschlitz and James L. Foote directors. They will organize on August 8, and the old officers will doubtless be re-elected. They are Mr. Johnson, president; Mr. Bittner, treasurer; Morris Hoats, Esq., and F. A. Kreitz, secretaries.

International Stone-Cutters' Union, No. 1, Chicago, Cook county, Ill.; incorporators, Jacob Ingenthorn, A. W. Schroeter and M. W. Cagney.

The Linton Onyx Marble Company, of Spokane, Wash.; capital, \$250,000.

The Keystone Granite Company, operating marble quarries at Pacolet, S. C., has made application for a charter of incorporation, to have a capital stock of \$100,000.

St. Louis, Mo.—A chattel deed of trust given by the Grant Quarry Company was placed on record June 8. The deed covers the real and personal property of the company wherever situated, and secures a claim of the German American Bank of \$9,000, and forty-five other creditors whose claims aggregate \$9,884.96.

Philadelphia, Pa.—A foreign attachment was issued by J. A. Ridgway against the White Cliffs Portland Cement and Chalk Company, an Arkansas corporation, with bail fixed at \$3,000, for a debt of one-half that amount, and the Missouri, Kansas and Texas Trust Company, of Kansas City, summoned as garnishee.

Mankato, Minn.—Judge Severance has filed an order decreeing a foreclosure and directing a sale of the Mankato Lime and Stone Company quarry to satisfy a mortgage of \$3,000 and interest held by Robert O. Craig, of Janesville. This property was sold in March to satisfy a mortgage for \$8,500 held by eastern parties.



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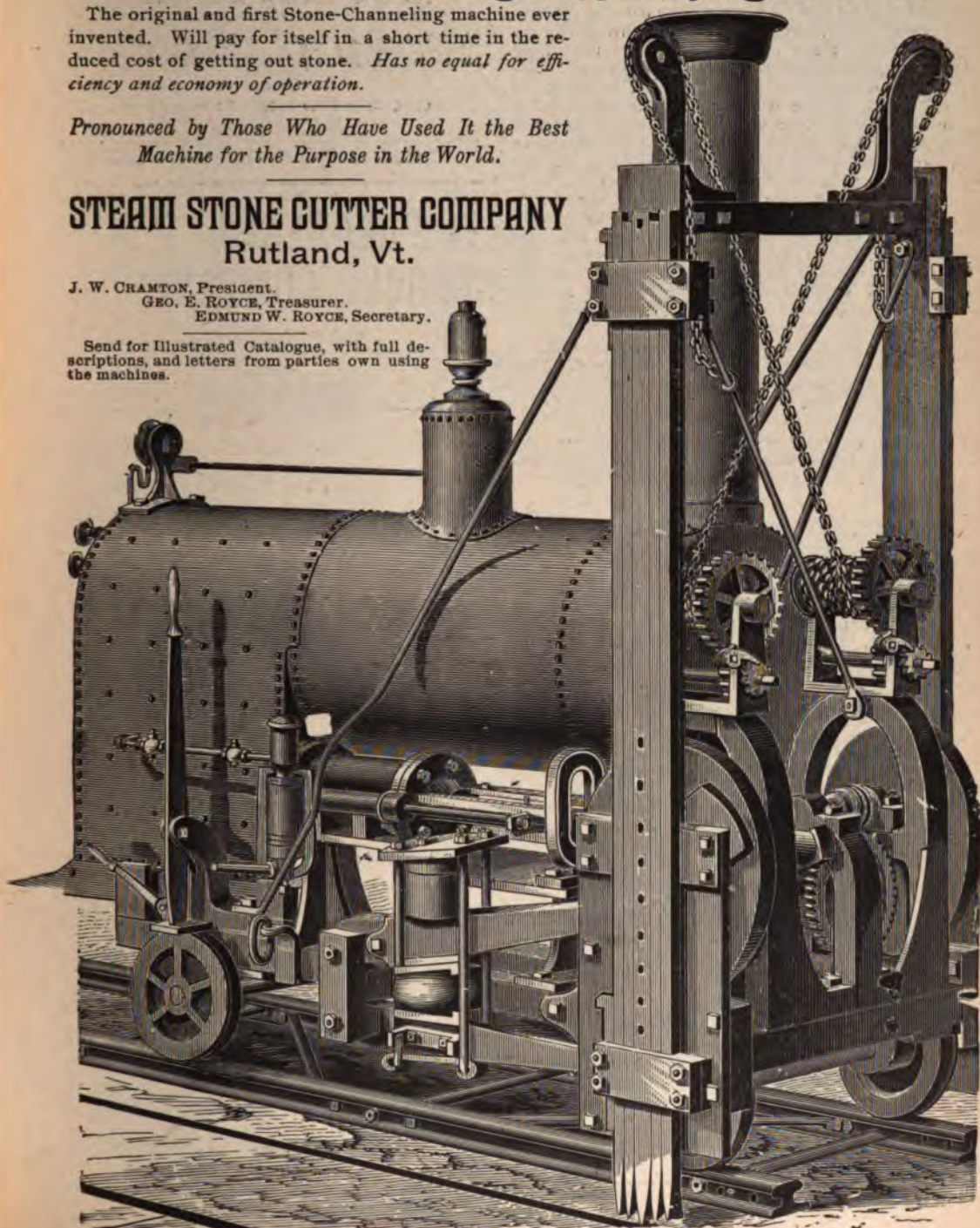
The original and first Stone-Channeling machine ever invented. Will pay for itself in a short time in the reduced cost of getting out stone. *Has no equal for efficiency and economy of operation.*

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The real estate and personal property of the St. Lawrence Marble Company, Gouverneur, N. Y., was sold at public auction. The property was sold subject to two mortgages, one for \$6,000 and one for \$10,000, one bearing interest from Jan. 1, 1898, and the other from July 1, 1895, and a contract on which there is still unpaid \$500, with interest from July 1, 1895. The real estate was bid in by Mr. Belding for \$10,000, and he secured the personal property for \$1,000. The company's bonds aggregate \$110,000, of which amount Mr. Belding and his friends held about 8 per cent. One of the terms of the sale was the payment of \$10,000 of the purchase price to the referee at the time of the sale. The deeds will be given to the new owner on August 11. Mr. Belding, the new owner, said that as soon as he secured the deed he would arrange to start the plant and that it would run as strong as the market would warrant.

Passaic, N. J.—The sale of the quarry of the North Passaic Brownstone Company was held recently. Mrs. Kevitt, wife of Councilman Cornelius Kevitt, bought it in to protect her husband's interests. The sale was forced by Alfred Burrows, who held a mortgage on the quarry when Venable & Fisher, the former owners, sold out to C. Kevitt and John S. Oliver.

Carthage, Mo.—The plant, real estate, tools and cut stone belonging to the Carthage Quarry and Construction Company was sold at trustee's sale. The creditors mentioned in the deed of trust are G. M. Viernow, German-American Bank, O'Connor & Coughlin, H. W. Elliott, and the St. Louis & San Francisco R. R., of St. Louis; M. F. Viernow, Keim & McMillan, and the Carthage Coal and Commission Co., of this city. The total liabilities amount to about \$12,000. G. M. Viernow, of St. Louis, was the heaviest creditor, his claim being \$6,216. There were but two bidders, Messrs Viernow and Meyerberg. Mr. Viernow started the bidding at \$6,600, and the property was knocked down to Mr. Meyerberg a few minutes later for \$8,300. The property secured by Mr. Meyerberg is a valuable one. The plant is complete and there are now about 9,000 cubic feet of sawed stone on the ground.

The Mount Airy Granite Company, of Greensboro, N. C., has leased its entire property to Thomas Woodroff, who is operating the quarry.

Chicago.—James Sullivan, one of the stone-cutters who are accused of complicity in the murder of John Finnegan, president of the Stationary Engineers' association, has been released from jail. His lawyers obtained \$10,000 bond for his appearance. William Cavanaugh,

the other accused stone-cutter, is still in jail. Judge Gibbons passed the hearing of the writ of habeas corpus which was sought to have the men's bonds reduced.

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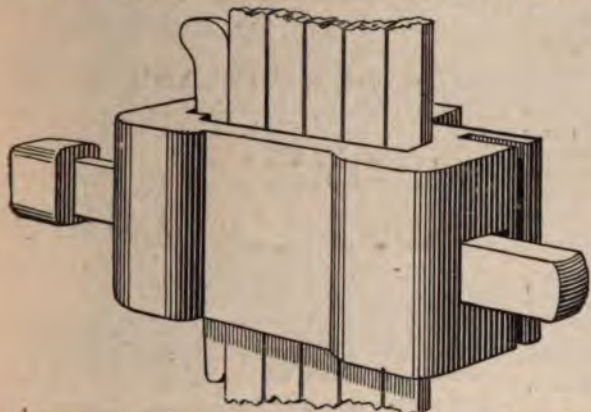


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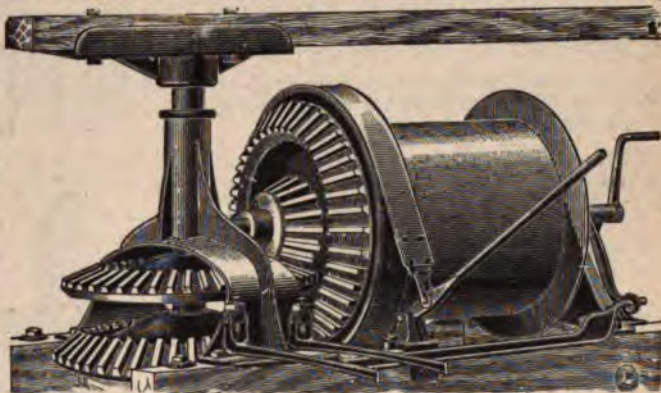
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Bedford, Ind.—Application has been made for a receiver for the Sterling Stone Company, operating a quarry near this city, by J. E. Evans, a creditor, who alleges that the company is insolvent, and is about to sell its plant, without making provision for indebtedness. A temporary restraining order was granted, and a final hearing was had by Judge Martin on the 22d ult.

Cincinnati, O.—Attorney Charles Hunt filed a motion to set aside the assignment of Charles McDonald, the marble dealer, who, residing in Covington, recorded his failure in Cincinnati as well. The question whether a deed of assignment filed by a non-resident is valid has not been tested in the upper courts. The purpose of this move is to upset the preferences which McDonald made in Ohio—something he could not do in Kentucky, because of lapse of time.

Bedford, Ind.—Upon the application of W. N. Matthews, who holds mortgage claims. C. S. Norton has been appointed receiver for the Standard Stone Company.

Louisa, Ky.—R. L. Hopkins will establish a marble yard.

Doylestown, Pa.—Frank L. Worthington has discovered a quarry of the finest grade of building sand on his property. The quarry was opened for stone, but sand has been found in immense quantities.

A new stone quarry has been opened near New Paris, O., where there are valuable deposits of stone.

Findlay, O.—Some piking company is pumping the water out of the Bott quarry, and getting ready to crush stone for road purposes.

Kasota, Minn.—Babcock & Co. are opening up a new stone quarry.

Mt. Carroll, Ill.—F. A. Ehmer, proprietor of the Lanark Marble Works, with his brother, who conducts a similar business in Rock Island, will start a marble shop in this city.

Decker & St. Clair, of Lakewood, N. J., have been awarded contract for large new church at Winsted, Conn. It will be built of Torrington granite, for which a quarry will be opened near Torrington.

Lexington, Ky.—James E. Pepper & Co. sold to W. B. Hubbell & Co., of Cincinnati, for \$18,000, thirty acres adjoining the distillery property on the Frankfort pike. This is an immense rock quarry and out of it Hubbell expects to supply the L. & N. R. R. with stone for ballast.

J. T. Cummins, of Louisville, Tenn., who has been engaged in the marble and mining business for some time, has leased a quarry of fine black marble near Greenback.

Hop, Pa.—George Case has sold his interest in his stone quarry to I. M. Carpenter, at Nicholson.

Seneca Falls, N. Y.—The stone quarries of this place have been leased by the parties who have the contract for paving the streets of Geneva.



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xix

CONTRACT NEWS.

South Bend, Ind.—Norman Eddy Post, of this city, Charles Pratt, commander, has taken steps to secure the co-operation of all the Grand Army posts in this county to erect a soldiers' monument in this city.

Muskegon, Mich.—The contract for the erection of the statues of Lincoln, Grant, Sherman and Farragut, donated to this city by Charles H. Hackley, has been awarded to the Harrison Granite Company, of Adrian, for \$25,700. The contract price exceeds by \$5,700 Hackley's gift, but the philanthropist will supply the deficiency. Work must be completed in eighteen months.

Port Huron, Mich.—It is reported that the Grand Trunk Railway Company will build a large round house near Sixteenth street this fall. The new building will cost about \$25,000.

Cherryvale, Kan.—The proposition to vote \$20,000 to aid the Kansas, Oklahoma Central & Southwestern Railroad carried by seventy majority. This city is to be the northern terminus and the shops, round house and headquarters are to be located here.

Helena, Mont.—Sealed proposals will be received September 13, 1898, for furnishing all labor and material and erecting complete a three-story, fire-proof brick, stone and iron capitol building, to be erected in the city of Helena, Mont., and all to be in full accordance with the plans and specifications therefor as prepared by Bell & Kent, architects. Proposals must be addressed to E. B. Kennedy, and must be accompanied by a certified check in the sum of \$5,000. Plans and specifications can be seen at the office of the architects, Nos. 27, 28 and 29 Merchants' Bank Building, Helena, Mont., on and after August 15, 1898, or duplicate copies can be had of the architects by making satisfactory arrangements for their use and return. E. B. Kennedy, Sec'y.

Alexandria, La.—The police jury have set aside a sum of money toward building a \$20,000 jail in Rapidas county.

Steubenville, O.—The Catholic congregation of the Holy Name are taking the first steps toward the erection of a church early in next year. Rev. James J. Hartley, rector.

Colorado Springs, Col.—The First M. E. Society is taking steps toward erecting a \$35,000 church. Wm. Lennon has subscribed \$10,000 for the purpose.

Creston, Iowa.—Plans are being prepared for a \$50,000 depot, to be erected by the Chicago Burlington and Quincy Railway at Creston. E. J. Blake, Chief Engineer of C., B. & Q. Ry., Chicago.

Des Moines, Iowa.—Press report states that a \$100,000 brewery plant will be established by Wm. Aulman.

Wabash, Ind.—The new M. E. congregation being organized because of the division in the old church will build a \$20,000 church.

Fargo, N. D.—Cathedral. St. Mary's Catholic Society, owners. Rt. Rev. J. Shanky, pastor. Bassford & Donohue, Gilfillan Bldg., St. Paul, architects. Cost, \$25,000; 63x152; brick and stone.

Decatur, Ill.—The Illinois Central Railway Company will build a two-story depot at Decatur.

Louisville, Ky.—Synagogue addition. Adis Israel Society, Dodd & Cobb, Equitable Building, architects. Cost, \$12,000. Brick, stone, stone trimmings.

Paris, Ill.—Press report states that a new passenger station will be erected by the "Big 4" this season.

Ft. Madison, Iowa.—Press report states that the Burlington Railway will build a new depot at Ft. Madison. Estimated cost, \$12,000.

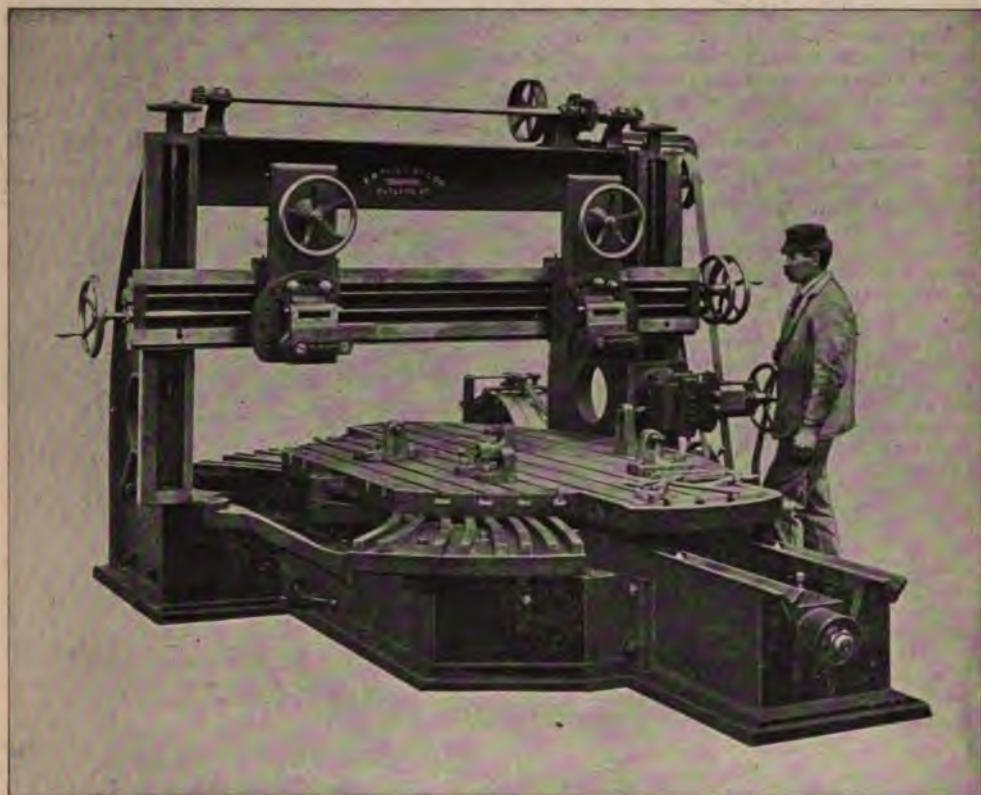
Pennsburg, Pa.—Milligan & Webber, of Philadelphia, are completing plans for a one-story and basement stone church for the congregation of the German Lutheran Church of Pennsburg. It will be constructed of granite and trimmed with Indiana limestone, and is estimated to cost \$30,000.

Detroit, Mich.—The Michigan Malleable Iron Company has been reorganized. Capital stock has been increased from \$100,000 to \$200,000. The reorganized company will erect a building covering five acres on the River Rouge and will give employment to 800 men. The equipment of the new building will cost \$10,000 and electricity will be used wherever practicable.

Duquesne, Pa.—The Church of the Holy Name has decided to build a church at a cost of \$50,000, with a seating capacity of 1,000.

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XX

Columbus, O.—The State House Commissioners have accepted plans prepared by Samuel Hanneford & Son, of Cincinnati, for the annex to the State House. The interior construction, a steel skeleton with steel columns, girders and eyebeams. Each office will be provided with private toilet rooms. The architects estimated cost of the new building is \$305,656. This does not include furniture or fixtures of any kind.

Fremont, O.—Sealed proposals will be received at the Auditor's office until to August 8 for necessary materials and performing the necessary labor for the building of an addition to the court house in Fremont, Sandusky Co., O. Each class of work and materials to be separately bid upon; to which may be added a bid for the entire work including materials. Plans, specifications and bills for materials may be seen at the auditor's office on and after July 7, 1898. Blanks for bidders furnished on request. Samuel J. Hirt, Auditor of Sandusky County, Fremont, O.

Toledo, O.—Sealed proposals will be received August 3, 1898, for furnishing the materials and performing the labor necessary to construct a county jail, to be in accordance with the plans and specifications prepared by David Stine, architect. All bids must be made according to law, and on blanks which will be furnished by the County Auditor on application. Wm. M. Godfrey, County Auditor.

Columbus, O.—The Town Street M. E. Society have decided to build a \$30,000 church. Plans prepared by Yost & Packard. Geo. Bellows, chairman of building committee.

New Orleans, La.—Plans and specifications are now being prepared by the city engineer for a police jail. Estimated cost \$30,000.

Allegheny, Pa.—The second Presbyterian Society will build a \$28,000 church.

New Orleans, La.—Bids are being prepared by H. W. Phillips, Rochester, N. Y., for the erection of a Baptist church at New Orleans. Estimated cost \$80,000.

Louisville, Ky.—J. J. Gaffney has prepared plans for a \$13,000 church to be erected by the St. Valentines Catholic Society. Stanilaus Brylski, Leo Lugowskie, building committee.

Jacksonville, Fla.—A company has been organized with a capital of \$50,000 to build an opera house with a seating capacity of 2,000. W. N. Emery.

Columbia, S. C.—Plans have been prepared for the erection of a \$25,000 union depot. Address J. H. Sands, general manager of the South Carolina & Georgia Ry. Co., Charleston.

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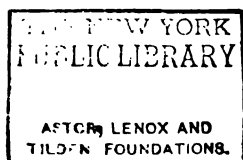
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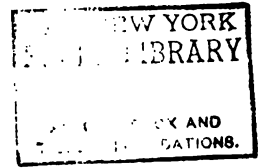
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MEMORIAL BRIDGE AND ARCH, HARTFORD, CONN.



VOLUME XVII.

SEPTEMBER, 1898.

NUMBER 4.

HARTFORD MEMORIAL BRIDGE AND ARCH.*

ONE of the handsomest stone arch bridges in the United States is the brownstone structure in Bushnell Park, at Hartford, Conn. Its effectiveness is largely due to the Memorial Arch, over the driveway leading up to the Capitol building.

The bridge was constructed originally in 1850, of Portland brownstone, and at a cost of about \$15,000. Of the five arches, each having a span of twenty-five feet, the three center ones are semi-circular, while the two end ones are three center, with radii of $8\frac{1}{2}$ feet and $14\frac{1}{2}$ feet. The original width of the bridge was thirty-five feet, but in 1885 it was rebuilt to match the Memorial Arch, and the width increased to forty-one feet extreme, or with a roadway of twenty-eight feet and two sidewalks of four feet each. The widening was accomplished by tearing down the spandrel-walls to the top of the arch rings and supporting the added width by elegant stone brackets, adding much to the beauty of the bridge; while the design was made to harmonize with the Memorial by a parapet railing of elegant design.

The remodeling of the bridge cost \$11,287, while the cost of the Soldiers' Memorial was \$60,000. This was executed in brownstone and terra cotta, from the designs of Mr. Geo. Keller, a prominent Hartford architect. The two structures, when considered as a whole, form one of the most notable of monumental works.

"F."

*Subject of Frontispiece

MARBLE VS. GRANITE.*

I WAS led to this topic by a recent study of the various marbles and granites of this country, with reference to their adoption in the construction of the Wade Memorial Chapel and Receiving Vault now building at Lake View Cemetery, Cleveland, O. The present Mr. Wade thought that the white terra cotta, which is much used of late, would be a suitable material, but on further reflection this was discarded in favor of stone.

The design of the building has a row of columns along the side, behind which are plain walls to which terra cotta is not well adapted, since its surface is not perfectly true. Again, with terra cotta we should require metal beams in the lintels, veneered with this material. It is true that had the building been designed in metal and terra cotta the metal columns would have cost only \$60, while the marble columns would have cost \$800 apiece. Nevertheless, for the sake of sincerity and good taste, marble was the material selected, and it was proposed to use white marble, but we soon discovered that all white marble is not white.

Mr. Norcross recommended the Georgia marble, and so did Mr. Tiffany. This has been used in building the State Capitol at Providence and the Corcoran Gallery, Washington. The only building we know of which is really white is the Mausoleum at Detroit. This is built of Rutland marble. ⁴⁵

The surface of marble soon disintegrates in the climate of Cleveland, and becomes granular as well as discolored. Old tombstones in the city graveyards show this, and would hardly be recognized now as marble. However, a protective fluid may be used with which new marble may be saturated, so as to become weather-proof and thoroughly durable.

We found South Dover and Tuckahoe marbles used in New York City. The Lee marble is largely used in Washington and Philadelphia, but this acquires a bluish gray tinge and the Tuckahoe turns brown. It has certain defects called "shakes," and contains some particles of magnesia, which dissolve in wet weather and leave the surface pock-marked.

The Vermont marbles were examined in the quarries and in buildings. No old marble was found in New York City that is not more or less discolored and disintegrated. The top surfaces are both rough and dark, while the under sides of projections are in good order. The Vermont quarries are probably the largest marble quarries in the world. These are at Proctor

*Extracts from an address by Benjamin S. Hubbell, at the July meeting of the Civil Engineers' Club, of Cleveland, O.

and West Rutland. The buildings of the quarry company are built of marble taken at random without selection. They are therefore quite mixed in color and give a really fine architectural effect. The owners were quite surprised at our admiration of these buildings.

The quarries have been excavated to a depth of 150 feet, crossing the beds of marble, which lie at a steep angle, and then have been tunneled horizontally to cross the beds again. Several beds are found superimposed. It is seldom that a bed is more than thirty inches thick. The blocks are sawed into slabs regardless of the original bed, but so as to leave a white face, if possible. The marble in the same vein will be partly white and partly colored. The so-called fancy marbles all come out of the same quarry—red, white, black and blue—and sometimes even out of the same piece. The whole plant of these quarries is very fine. The Rutland marble is easily cut into fine lines and ornamental figures. On the other hand, Georgia marble is hard to cut and unless great care is used large crystals will break out in cutting.

The building committee advised the use of granite, but the architects desired to use marble protected, which would be more beautiful and susceptible of elegant ornamentation, and would last a long time. But Mr. Wade said he wanted a building that would last five hundred years, therefore the idea of marble had to be abandoned.

Many samples of granite were sent to the architects. Granite is refractory and has to be tooled by hard and patient labor. Pneumatic tools have been invented for undercutting, but plain surfaces are generally worked by hand. Granite does not lend itself to fine ornamental lines and its gray color prevents the best effects of light and shadow.

Of course it was necessary to change the ornamental design of the building to suit the change in material and arrange for heavier blocks in the walls. Marble can be used as veneering. It can be sawed as thin as five-eighths of an inch, but granite must be in blocks.

The granite found in the Barre quarries occurs in layers separated by parallel seams through which water trickles. The stone next the seam is consequently saturated and is called the sap. The sap is rejected in building, requiring a dressing off of the blocks of two or three inches from each bed. Usually granite blocks are split apart, though some sawing is done with chilled shot. At these quarries rotating disks are used to dress granite surfaces. The stone is first roughly pointed by hand and then run under the machine, which dresses off the surface to an absolute plane. This result is seldom obtained in hand work. In hand dressing a "number ten cut" (which means ten bits in $\frac{5}{8}$ of an inch) is about the best, but more depends on the skill of the laborer than upon the number of bits to the inch.

Of all the granites the North Jay seems to have the lightest color

Grant's tomb and the new Bowling Green building, New York, are built of this. It is, however, rather porous and soft and occasionally discolored by iron. A few defective blocks may spoil the effect of an entire building. Westerly granite is the darkest of all. The Concord granite is used in the Congressional Library building at Washington. It contains some particles of magnesia. The Troy, N. H., granite is light and sound and of good quality. It forms the steps of the Congressional Library. The Hallowell granite was used in building the State Capitol at Albany. Barre has the most prolific quarries in America, but the product is liable to have iron in it, at least in the sap. Small specks of iron, hardly detected in the first instance, will later dissolve and streak the whole surface. However, it has been used for twenty-five years, and some monuments built of it are still as good as new. Many fine specimens of this granite may be seen in Lake View Cemetery.

The Hallowell granite is the best and most expensive, and is largely used for monumental work. It is homogeneous, all sections presenting the same appearance in whatever direction they are taken.

It was finally decided to use either the Troy or the Barre granite in the Memorial Chapel.

THE WHEELING STONE ARCH.

THE Wheeling stone arch bridge is one of the largest stone arches in the United States, having a span of 159 feet. The intrados is the arc of a circle, with a rise of twenty-eight feet. The depth of key-stone is 4' 6". Longitudinal arched voids are employed underneath the roadway.

The engineers of the work were Hoge & White, the bridge being completed in 1893. The large span marks the structure as a notable piece of engineering work, and the detail of the parapet is very pleasing in appearance, although very simple in design. The coping with the supporting corbels is also very effective. Berea stone was used for most of the work, which amounted to about 9,000 yards, there being 6,000 yards of dimension stone. The cost of the bridge was \$130,000.

The meeting of two straight grades at the center of the span is hardly the best solution possible for giving increased waterway, although plenty of precedent can be found for such an outline. A much more pleasing method would have been to use a parabolic curve for the longitudinal profile of the roadway and coping.

Had the offset in the retaining wall been made at the springing of the arch, as a division between the spandrel and retaining walls, it would have been more logical and the effectiveness of the structure as an architectural work much heightened.

"F."



THE WHEELING, VA., STONE ARCH.

MAKING A LIFE MASK.



HARRY TURNER HEMS, IN THE UNIFORM OF
THE CYCLING CORPS OF THE FIRST
RIFLE VOLUNTEERS, BRITISH ARMY.

THE taking of masks from the dead by any but a skilled operator accustomed to such work is distinctly disagreeable and difficult, and perhaps particulars of the *modus operandi* upon such occasions will somewhat disturb the nerves of our more sensitive readers. In the accompanying interesting photographs we are able to illustrate the process of obtaining a mask of the face during life, the subject operated upon being far from dead.

Dead masks are usually taken for the purpose of securing an exact reproduction of the features, so that any artist or sculptor who intends to execute a painting or statue of the deceased may have something definite to work upon. One often observes when reading of the demise of a celebrity that a mask was taken by Mr. So-and-So, the celebrated sculptor, soon after death, but

really very few people know how this is carried out. They might have some idea that plaster of paris is put over the dead man's face but there the idea ends.

A mask from life is taken almost precisely as after death, save that greater care has to be used as the subject's life hangs on a very thin thread, or, to be more precise, two small quills. It requires a great deal of nerve and patience to undergo, the sensation being most disagreeable. When a mask from life is about to be secured the subject reclines on a long table, and towels are placed around his neck and forehead to prevent the plaster



FIG. 1.—INSERTING THE QUILLS.



FIG. 2.—APPLYING THE PLASTER.

going where not intended. The face is slightly greased but not enough to fill the pores of the skin. Care has to be especially taken with the eyelashes, as otherwise, in the subsequent operations, they are likely to be pulled off, which would not be exactly pleasant. A small quill is now inserted in either nostril (Fig. 1) to allow the subject to breathe through, and cotton waste lightly pressed round the base to keep the liquid plaster from intruding. A pair of scissors is always kept handy, so as to be able to cut off the tops of the quills, should by any chance the plaster splash up and cover them. All being ready, a few cheering words spoken to the victim, and the plaster is mixed. This is carefully poured or sprinkled over



FIG. 3.—THE SIGNAL, "ALL'S WELL."

the features (Fig. 2). The following operations have then to be performed with skill and celerity: Directly the plaster covers the face a small but strong thread is laid on either cheek, running from the top of the head to the neck, and is pressed into the plaster until it almost touches the skin. Additional plaster is now placed on until the whole is about an inch in thickness. Before this is quite "set" the before-mentioned threads are pulled up through the mould so as to cut the plaster, otherwise it would be impossible to remove it from the face.

The subject whose mask is being taken has now a lively time. The plaster presses and burns his cheeks. He thinks of all the horrible things that *might* happen if those two little quills became choked. Not a sound of the outer world can he hear save some indistinct rambling, and the thud,

thud of his beating heart almost deafens him. Hours seem to pass and he is powerless to know what is going on. He lays helpless there and perhaps out of curiosity tries to raise an eyelid. That settles him, as by this time the plaster has hardened and holds the lid in an immovable grip. A sickly sensation comes over him—he feels paralyzed and unconsciously gives a long groan. This, by the way, can only come through the quills in his nostrils and it naturally alarms the operator who immediately shouts as loudly as he can to know if anything is the matter. The subject is just able to hear his voice and so raises his hand (a prearranged signal) that "all's well" (Fig. 3).

The plaster though being mixed with warm water quickly hardens, and in the course of about 5 minutes the mask is strong enough to be taken off. It has to be carefully done, as the subject is generally so



FIG. 4.—HOW THE MOULD IS CUT.



FIG. 5.—THE MOULD IN PIECES.



FIG. 6.—THE MOULD READY FOR FILLING.

ears out without breaking either the subject or the mould. The ears are only taken on the front sides, cotton wool being placed at the back to prevent the plaster going around. When removed the three pieces are put together and plaster placed on the exterior to hold and strengthen them.

In Fig. 5 we see the mould directly it came from the face, but by a peculiarity in the light the center piece almost appears to give the face in the round. But this is not so. It simply shows it as a negative, all prominent parts such as the nose being darker. The ends of the two breathing quills and the cotton wool

eager to get a mouthful of fresh air once again. A slight tap with the hand is given to the two side pieces which relieves the joints made by the thread. The top or central piece is then lifted up and pulled slightly downward so as to withdraw the quills from the nose as they come with the mould (Fig. 4). The sides are then taken off. Probably some of the hair may hold the mould, but with a little coaxing, or by the insertion of the scissors, it can soon be removed. Care must be taken to get the



FIG. 7.—CHIPPING OFF.

supporting them may be seen in the nostrils.

The mould (Fig. 6) is now well washed and soaped and then filled with freshly mixed plaster. It is best to take it in the hands and give it a slow rotary motion so that the plaster may lay evenly on every side. When this has quite "set" the mould is chipped off with a mallet and chisel (Fig. 7). Through being soaped it easily comes away from the mask and leaves an exact replica of the face. As a rule the mould is taken from the top of the forehead to the neck and reaches outwardly to the ears. When taken from life a great deal depends on the quickness and dexterity of the operator, as many unpleasant if not serious results, may occur through any laxity or carelessness on his part.

It is curious to relate that in connection with this series of photos the subject on issuing from the mould being asked what his feelings were, remarked that he felt as if under the influence of drink. This, coming from a lifelong abstainer, is somewhat surprising, and suggests the query as to

how he recognized that condition.

In the photographs (Figs. 8 and 9) we give two views of the finished mask, one taken from the front and the other in profile. The mask, of course, shows the face in repose, with the eyes closed, but any artist with a little skill would have no difficulty in afterward working up the eyes



FIG. 8.—THE MASK, FRONT VIEW.



FIG. 9.—THE MASK IN PROFILE.

so as to make them appear as if opened. When the subject has a beard or a heavy moustache it has to be made into a solid mass by the aid of vaseline or soft soap. An easier way in the case of a beard is to cover it with tissue paper. This prevents the plaster from going into the beard and it comes away easily with the mould.

The whole process is most interesting, and the amateur, hardly able to take a mask of the human face, may most certainly take a hand or a foot, or the head of a dog, or any other animal after death, and get some very curious and practical results.

The photographs illustrating this article were taken especially for it in the studio of Messrs. Harry Hems & Sons, Exeter, England.

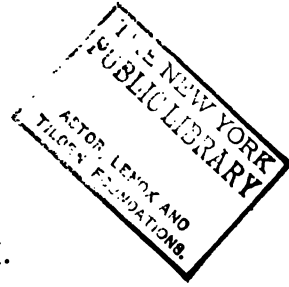
Harry Turner Hems, Jr.

DIDN'T LIKE SIGHT DRAFTS.

SOME people are very sensitive about having sight drafts drawn on them, and others prefer to have their creditors draw on them rather than to be bothered about keeping track of the time when bills mature. Some very amusing incidents arise in the collection department of every business. Here's the latest: A Kansas City firm which deals in a commodity on which the limit of time is sixty days, and that only by special agreement, had shipped a bill of goods to a customer, and on the first of the month sent a statement. There was no response, and the first of the following month another statement was sent, with the request, "Please remit," but this did not bring the expected remittance. Another statement was sent the following month, with an urgent request for payment, and notice that draft would be made, and still no answer. In a few days a draft was drawn on the party and sent for collection, but was returned, marked, "Refused payment." Then a letter was written demanding an explanation, which brought the following reply:

"Yours of the 14th at hand this a. m., asking why I did not pay your sight draft. In reply would say, that I never pay a sight draft, nor will I ever. There is no law compelling a man to pay a draft, and no serious penalty for not paying one. You just simply delayed the payment by making draft; I had the money all the time, but it was an oversight by not sending it sooner. You say I must send the money hereafter with orders. In reply to that will say that if you don't want to ship me goods without the money, you can ship them to h——. There are others."

The firm replied that in the future they would follow his directions about shipping, supposing he would be there to receive the goods, but that they could not guarantee them against heat.—The Implement Trade Journal.



COCKERELL ON THE MAUSOLEUM.

THE writings of the late Professor Cockerell, R. A., have fallen into undeserved neglect. With the following description of an attempt to restore the Mausoleum at Halicarnassus some of our readers may be unacquainted, says The Architect, London. It was addressed to the late Sir Charles Newton, of the British Museum:

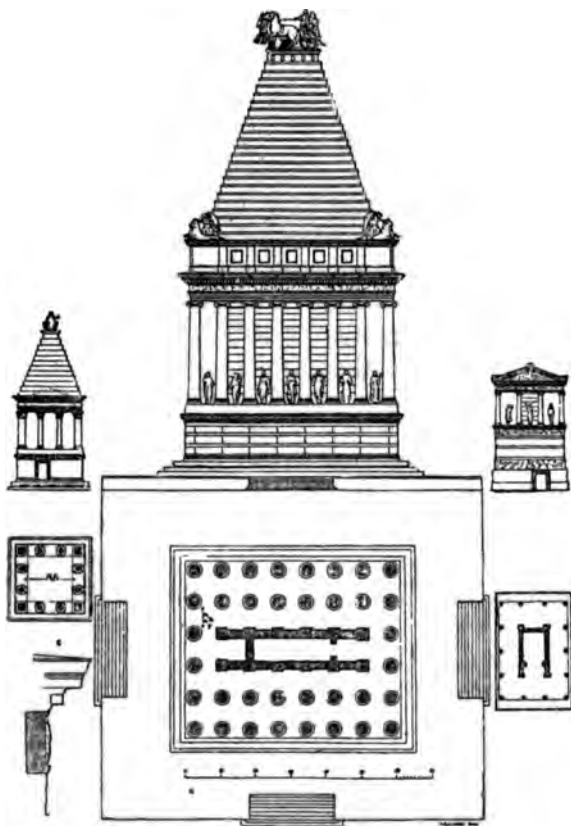
The best answer I can give to the questions you do me the pleasure to address me on the subject of the Mausoleum, will be in the artistic language of the inclosed sketch. I will not enter into a critical discussion on this passage, and on the numerous commentaries that have been written in explanation of it; my business, as an architect, is to adhere as nearly as possible to the received text as the programme of my restoration.

The inclosed drawing exhibits an elevation and plan agreeing with the height, width and entire circuit given by Pliny. Beside it, on the same scale, are the tomb at Mylasa and that at Xanthus, which, according to the analogy of all architectural history, must have resembled the Mausoleum, more or less, in its principal features.

One great advantage which we possess over all former commentators on this subject, is the recent acquisition to our Museum of the marbles from the fortress of the identity of which with the celebrated sculptures described by Pliny I can entertain no doubt. This frieze establishes a very essential fact, viz. the dimension of the order to which it belongs. The relative proportion of the Greek orders being fixed, we ascertain their entire size by a part, as we should that of a statue by a single member "ex pede Herculem." The frieze being 2 feet $5\frac{1}{4}$ inches in depth, we obtain an order of $37\frac{1}{2}$ feet,* and, applying this order to the dimensions given of the whole by Pliny, 63 feet in the flanks, on the fronts brevius, we find first, a correspondence with one of Pliny's dimensions, 25 cubics, which is remarkable, and may possibly explain that part of his text, and, secondly, from the adjustment of the diameters and inter-columnations of such an order to the dimensions of the sides and fronts and the number of columns given; viz. 36, we have a structure of great beauty and wonder. By such an arrangement the pyr-

*The diameter of the columns was probably about 3 feet 4 inches, a respectable dimension, and exceeding by one-half that in the French restorations. I have given the frieze that larger proportion which the Ionic examples of Athens afford, rather than the Asiatic. It may well be presumed that a frieze destined to receive workmanship of so superior a quality might have the utmost extension which the order admitted.

mid is supported in the air, literally as Martial has expressed it,* and reposes on a grove of columns, pervious to the eye, yet offering a full and sufficient means of sustaining the superincumbent weight by supports distributed at intervals of 6 feet or thereabouts over the whole surface of the plan, longitudinally and transversely. That so bold and unusual a mode of sustaining the superstructure may have existed we have evidence in the tomb at Mylasa, which was still more astonishing in this respect, though



smaller in dimensions, since the pyramid was sustained on a periphery of twelve columns, the interior space having no support whatever, and offering a void of 14 feet, while in the proposed restoration that void does not exceed 6 feet.† The conditions of taste appear to me to be sufficiently fulfilled by the arrangement I have proposed; we obtain a disposition most approved in Greek architecture, having eight columns in either flank, and six in either front, and six in either flank in the second row,‡ making a total of 36.

The next point to notice is the narrow and elongated cella resulting from this plan, a remarkable authority for which

has been discovered in the remains of a monument from Xanthus, lately acquired for our Museum by the labors of Sir C. Fellows, the restoration of which shows that a tomb was not disposed as a temple, with a cella ample

*In the line from the "De Spectaculis".—"Aere nec vacuo pendentia Mausolea."

†It is by no means necessary to suppose the superstructure of the pyramid to have been a solid. The pillars may have been elongated as piers above the entablature, so as to carry a pyramid of ashlar construction similar to that of Mylasa.

‡In the language of Greek architects, peripteral, dipteral, pycnostyle in the flanks, and systyle in the fronts.

enough to receive the statue of a god, but simply as a receptacle of the remains of the body, perhaps of a statue, in honor of the deceased.* A consideration which has escaped most of the commentators, except Caylus, is the remarkable phrase of Pliny, "*in metæ cacumen se contrahens*," most of them having adopted the depressed pyramid after the Egyptian proportion. Now we have the meta constantly expressed in bas-relief and ancient painting, and always in an elongated conical form, a form perfectly adapted to this kind of structure, which was to strike rather by its altitude than its spread, and which, indeed, reposing upon an elevated cubical base of perpendicular sides, would thus present a much more harmonious inclination than that of the Egyptian pyramid. The inequalities of the sides of this parallelogram are also remarkably adapted to the area which the quadriga at the top would occupy.

It would encroach too much on your memoir to explain the details, such as the podium, the order, and the Attic,† with which I have thought myself warranted, by direct authority or analogy with other monuments, to combine with the parts of this building already known to us, the requirement always being that we should produce, from all the evidence at our command, a probable restoration, at once beautiful and marvelous, and according with the universal voice of antiquity. You will see that I side with you in believing that this monument did not cover the whole space circumscribed in 411 feet, which is nearly two-thirds of that occupied by the Parthenon itself; for though the work of affection of a powerful queen, and at the same time a product of personal ambition in the illustrious artists employed, it is not likely that it rivaled the great national and religious monuments of the Greeks in bulk and expense, still less in earnestness of purpose and loftiness of motive. Indeed, a comparison of the elevation of the Mausoleum, with those of the monuments at Mylasa, and at Xanthus, as they are represented, will show that it is disproportionately extensive and magnificent for the class to which it belongs. A professional estimate of the cost rather occasions my surprise at so sumptuous an effort in a country so politically insignificant, and I would here venture the suggestion that Caria, like the smaller kingdoms of Naples, Bavaria, Sardinia, and others, furnishing the revenues and sustaining the office of a king without the national responsibilities which encumber more extensive monarchies, may have indulged, as we have abundantly witnessed in modern examples, a greater

*See the model in the Lycian room at the British Museum. That such an arrangement of the cella as it exhibits may be obtained from the fragments themselves, and the observations made by Mr. Rhode Hawkins, I was enabled to demonstrate to that gentleman when, by his ingenious father's introduction, I had the honor, as a veteran in antiquities of this kind, to be consulted by him.

†The choice of Ionic need hardly be adverted to, since its employment was almost universal in Asia Minor, or, we should say, in Ionia, the country of its invention.

magnificence of ornamental works than countries with greater territory and revenue, such as England, France or Spain.

May it not also be supposed that Artemisia, while she indulged that disposition to Sutteeism, which has always been applauded among the Asiatic nations, adopted at the same time a very wise policy in employing her hoarded wealth on a work which would occupy, during many years at least, that large body of artificers whom Mausolus must have assembled at Halicarnassus for the execution of his great works?

The hypothesis of a solid pyramid and cube surrounded by thirty-six columns, and those of a petty proportion, in a single row, is, as you remark, an inartificial and clumsy restoration of what we are told was a wonder of art; and such a structure would never have been made the subject of that dissertation by the renowned artists who reared it—Satyrus and Phiteus—the loss of which we must ever regret. Moreover, the solid mass would probably long have existed as a tower of defense, like Hadrian's Mausoleum, or that of Augustus, and would have left some traces at the present day; for it would not have been built of squared stones, such as might have been applied to the building of the subsequent fortress, but would have been of the order of masonry called "emplecton," or rubble, with layers only, and a facing of solid square stone, or possibly bricks, and much of the materials would consequently not be worth carrying away.*

Pray make such use of this essay as you may please—meanwhile I am rejoiced to offer in your society my tribute of admiration to the perseverance and skill, and true liberality, which have been so successfully exercised in our favor by Sir Stratford Canning at the Sublime Porte. By the acquisition of these marbles he has added an essential link to that chain of monumental evidence in our Museum, out of which may be developed the history of ancient art; while in these the acknowledged works of some of the most renowned artists of antiquity, we behold one more example of that Greek genius which will probably be followed with unequal steps by the present and future generations.

C. R. Cockerell.

*We learn from Vitruvius, ii. 8, that the palace of Mausolus was built of brick, the decorations being of marble.

MACHINE VS. HAND-CUT STONE.

It leaves us the lines and the spaces,
But the musical notes are gone;
Architectural beauty it defaces,
And like an outcast it stands all alone.

ARE we going to lose the true and beautiful principles of architecture by the use of machinery on stone?

Men of talent spend their youth studying these two principles in all their details, as well as the useful part of architecture, that they may launch forth in their mature years and raise up some grand structure that shall testify to the world that their talent and hard study have not been sown on barren soil. The two principles above referred to are of great importance in architecture, as they represent to the present world and the world to come the originality of the designer, and of necessity they must always go hand in hand together, as then they express in true and beautiful language the great principles of construction which the edifice, be it large or small, presents in all its varied forms to the eye of an observer, be he educated or otherwise.

The one will pay a silent tribute to the artistic point and skillfully planned design, while the other will be instructed and impressed as by some beautiful work of nature.

These tributes are paid to architects every day in the year, and I think they should try to guard and preserve their handiwork as far as it is possible for them to do so, and not succumb to that deadly enemy, the greed for gain.

Every style of architecture is governed by the above principles, and the architect who has earned a good reputation by hard work and strict attention to these principles, whereby the result—combination and harmony expressing the true order of his work—should not allow the durability of the material used to be injured by the use of machinery.

For his own good name, as well as for the benefit of science, he should seek to keep his reputation good so that due respect may be paid to his memory in some future time, for there is no art which receives such homage as architecture. No matter what city or country we may visit, its architecture is the rule without exception which creates our first impressions.

What can be more noble than a city whose architecture is built upon true and beautiful principles?—its preservation good, and all due care taken to keep it so. I am sure such a picture portrays more than anything else

the kind of people who inhabit such a city, for they ought to be in keeping with their surroundings.

Architecture is not like an art that can be copied from nature, such as painting or sculpture, it is an art which has grown up with man. From the shelter of trees, caves and grottos, they began when in a semi-civilized state to construct primitive buildings, or huts we might call them, of wood, then baked bricks and stone; afterwards some of the more intelligent began to form ideas of proportion, and architecture as an art began to grow, till it reached that pinnacle of perfection and sublimity which it is now and has been for centuries in respect to exterior decoration. As I said before, it cannot be copied from nature, therefore it behooves us to preserve it, or at least endeavor to do so. We owe more to the generations of the past in this respect than we realize at a casual glance, for it is owing to their strict attention and perseverance in seeing that the durability of the material used in the construction was in no way to be questioned that we have the fruits of their knowledge and skill to look at, learn a lesson from, and instruct our present students, and their created evidences of to-day stand and ought to inspire us to go and do likewise. Instead of doing this, we seem to be trying to destroy all evidence of our share in this noble art by allowing machinery to cut it, which stuns and shakes it to such an extent that the weather and frost will in a short space of time destroy all the beautiful profiles and forms, leaving no harmony, no combination of arrangements, unless it be a combination of wanton ruin.

All the architect's long nights of study wasted, his hard daily work counted for nothing, and a very dark spot on his reputation, in thus neglecting to see that his work was lasting, whereby the future generations have lost a thing of beauty, and some student a model from which to learn a lesson.

Let us hope that the architects of to-day will give this matter serious consideration, as it is of vital importance, for a few dollars saved in the construction of a building, have we to lose our reputation in this great art in such an age of progress? for be sure it will tell its own story.

Various samples of stone cut by machinery might pass even under a powerful microscope, but such samples are specially prepared, and not cut and driven at the rate in which the stone throughout a building is cut in general to-day. Some of our rich men have recently had homes built, and others are still building in the city and elsewhere, which they suppose will be lasting tributes to leave their children, but I fear some of the buildings will be greatly defaced before such a time arrives.

It seems a pity that such a state of things should be tolerated. It is becoming so that justice can neither be given to measurements required for good construction, nor the cutting of the stone; as machinery has made competition so keen architects and owners of buildings will be the ones to suf-

fer by it; the one will lose his reputation and the other will have a building which, from an artistic point of view, will not be worth the land it stands upon..

The people in general should see that no public building, either political or ecclesiastical, should have a machine used on them if they want them preserved as monuments of their industry, and it is only through the architects that this can be accomplished. Therefore in the cause of the people I speak, and still more in behalf of the art which every man should respect, as it shows more than anything else the upward struggle and progress of the human race.

It would be well if the architects would give a little thought and study to this subject, bearing as it does such a prominent part in their profession, and not allow all evidence of their skill and labor to crumble before its time, as assuredly it will under the present system if something be not done to arrest this artificial decay, as it may be called for want of a better expression.

Saying want, reminds me of "wanton waste and ridiculous excess;" it is a waste of good stone, waste of time, waste of architect's brain, waste of a draughtsman's brain, and waste of the builder's brain, and the mechanical aid brought in to cut it to excess, a thing which was never meant for stone, no matter how applicable it may be for other materials, makes it a ridiculous excess, and being excessive it cannot last.

There is one great evil which seems to be taking root since the introduction of machinery, and that is a style of building (I will not call it architecture,) is being introduced suitable and adapted to the planing machine; the effect is like a blank sheet of paper, the latter having this advantage, its blank faces may still receive the imprint of some master mind, that his knowledge may be transmitted to posterity, while the former tells of a falling away from art.

There is still another evil connected with machinery, and that is the degeneration of the practical workman; the rising generation of artisans in the art of stone-cutting will know very little of the fundamental principles of the trade, for all they learn is how to set in a mold for the planer, and joint the stone when finished.

Now this is a deplorable state of things, for let it be supposed that there is a fine building to be erected, for the construction of which there is no lack of funds, and a good supply of architectural skill and ingenuity, where shall we get the practical men to cut it? For surely in such a case machinery would be eschewed both by opinion and construction. The answer is, we should be under the necessity of importing them from countries where machinery has been tried and condemned for years before it was ever introduced in this country.

Machinery may be all right in its use on speculation work where the average life of a building is of short duration compared with some of the buildings handed down to us from our forefathers, but in large public buildings, in the adornment and durability of which we ought to try and surpass our forefathers, I say the use of machinery should be abolished.

Machinery is a product resulting from the progress of civilization and its inventive genius; its use has proved a blessing to mankind, but its application to certain things is limited; for instance, masterpieces in painting, in sculpture, in our famous violins, and in decorated architecture, the last not being least by no means.

The stone most commonly used for building purposes is susceptible to decay when exposed to the atmosphere, even when cut by the hand of a clever workman. What must be the result when it is shook, stunned, and its surface incinerated by the planer? More especially on delicate mouldings, which an architect should not trouble his brain to design if a planer is going to cut them, for in numerous cases the architect's original mold is changed to suit the planer, thereby his study being wasted.

The architect's work is not finished when he has prepared, after great labor, his general design throughout, and passed them over to his draughtsmen to put in details. It is his duty to see the material being used, test its durability, and see that everything is carried out according to his original ideas.

We have to lament one great architect lately deceased, one whom we may truly call the father of architecture in this country, that is, R. M. Hunt. He was the man to whom all true homage is due, in respect to his reverence and devotion to the noble art he studied and excelled in; he was a firm believer in stone being cut by hand; the numerous handsome buildings he planned are all hand cut, and they will stand as living monuments to preserve and honor his memory when all of us will have taken our allotted place in the greatest of structures, mother earth.

What a grand thing it must be to have one's name live after him in something beautiful—as his name lives compared with something on which no slur of disrespect can be cast. Such homage we pay to the late Mr. Hunt is surely sufficient to spur on the ones he left behind to endeavor to attain a like respect.

Then why not begin now; there is money enough in the country to enable it to become one of the leading architectural countries of the world, and I am sure we have the talent, if it is not abused by the curtailment of a paltry sum at the expense of the durability of the exterior structure, a point which is often overlooked and realized when too late. Therefore, band together and protect your art, build it up instead of helping it along on its path of degeneration, or the young and ambitious student of this grand pro-

fession will be like the rising artisans of stone-cutting, they will know nothing of the grand achievements of architecture except by reading and going abroad, whereas, by a little perseverance and exertion on the part of the present architects we could have a city whose architectural beauty would be a tribute and a lasting memorial to the progressive industry of the present generation of this enlightened nation, thereby creating a practical school of our own where our students would have a grand example before them to study at leisure.

Henry Gorse.

THE MARBLE MOUNTAINS OF ITALY.

THIS is the heart of the marble mountains, of those peaks and crags which bound the grass plains of Lucca and Pisa like a group of giants reclining on their elbow at table, and which, from the bridges of Florence and the heights above Siena, loom fitfully, a spectral wreath, so faint and immaterial as to be distinguished from storm-clouds only by their sharp and flame-like forms. I am seated under sparse, yellow chestnuts on the hill-side, above the quarry forge, smelling of dry balm and of myrrh. High up, so high that if I turn round I look across a series of descending ridges, not into the valleys, but down onto the sea. And close opposite, in front, abrupt, like the house facing one in a street, rises the great Monte Altissimo, serrated like a broken crystal, pure marble rock from crags to base. Bare marble rock, of faintest lilac where the weather has toned it, striped here and there with fainter cinnamon brown.

They are climbing up to the highest quarry, the famous Tacca Bianca, the White Scar. You see it from miles and miles away, like a great patch of snow with jagged outline against the sky, the stratum of whitest, most crystalline marble; the innermost core of the mountain, not excavated like the other quarries by the hand of man, but laid bare by the unceasing labor of sun and frost and storm. Up there, above and below the narrow ledges of road, iron wedges are driven into the rock, planks laid across them or slung by ropes, and the mountain side cut away into blocks by the quarrymen hanging on its face. The great White Scar faces me if I raise my eyes, white, hazy, in the blinding sunlight. And from the whole of the great mountain, mingled with the clear voice of the well-head below, comes a faint click of chisel, and every now and then the rattle of an avalanche of white quarry refuse, bounding from ledge to ledge.

The quarries of Monte Altissimo are only the highest and most wonderful among innumerable others of the twin valleys of Serravezza. They hang everywhere on the mountain sides, above the autumnal woods of chestnut and beech scrub, mere distant, snow-like patches when high up; and lower down great scoopings, wonderful crumbings of white marble, shale and

loose deep scarlet earth, runs of flabby debris, like overblown chrysanthemums among the thick groves of olive. Two torrents, glacier white with marble dust, twist through the double valley and make their way, a shallow quiet stream, among the yellowing poplars to the sands. And as they go they turn the sawmills, which grind quartz sand into the marble blocks and cut them into slabs. The roads are deep in marble dust, furrowed into enormous ruts by the strings of bullocks, sometimes as many as four yoke, carting the great slabs and rough-hewn blocks. Arrived at their destination, sawmill or storehouse, the drivers dismounted from between the huge horns of the oxen, and pry the blocks round on steel levers, chanting as they move. The block slowly turns on itself, balances on the brink of the cart, sways, topples, leaps down into the slush of pounded marble, heaves on its point and steadies on its side. The quite primitive labor of this carting and quarrying of marble is very interesting and beautiful. No two blocks seem ever to be alike, and they act as if alive, moving as the result, not of brute force, but of extraordinarily distributed skillful touch. Hence the men also seem alive, dealing with things which have a will. This struck me particularly in one of the lowest quarries of the valley, which we called the Red Quarry. It is a circular amphitheater, cut in crimson *carmine* earth, a few big olives and white walls of marble debris overhanging it, its entrance guarded by huge rough-hewn blocks. These blocks are covered on one side by a network of what looks like orange crystal or lichen, wherever the water has trickled; the other side is toned and stained a golden rosy flesh color, compared with which Giorgione's nudes and the Sabiaco Niobide are pale and cold. Above the quarry chasm of brilliant red earth, another quarry half hidden among the olives, and below immense, almost vertical runs of white and pinkish refuse, perpetually slipping and clattering into the river pools of the valley. It was down one of these rubbish slides that the men were preparing to launch a colossal block of marble.

The block was being lifted onto rollers made of undressed chestnut wood, in a sort of little square at the quarry brink, a few huts of leafage and some strange, primitive hand-saws, like those on obelisks, all round. About a dozen men, some really beautiful, and all with beautiful movements, were raising the blocks with their crowbars, singing like sailors as they pushed it along and eased it. At last it rushed along, like a boat on rollers, to the edge of the platform, all the men shouting as they ran. Then the pieces of wood, all but one, were picked away, and the block was raised on its point with the levers. The foreman, having got it eased all around, gave the signal, and it was launched. It ran down the steep shoot, some hundred feet long, gathering as it went the dust of the marble shale, till it was enveloped in what seemed a cloud of smoke, which continued along its

course. The hillsides *shook*; the block had arrived at the bottom. "How it smoked!" remarked the foreman.

These quarries of the valleys of the Serra and the Vezza do not appear to have been known in antiquity, which quarried marble, ever since the time of Augustus, in the other valleys, nearer the Gult of Spezia, of Luni, or, as we now call them, of Carrara. Michelangelo seems to have been the first to recognize that the Florentines possessed in their own territory (what he calls the mountains of Pietrasanta) marble as fine as any that could be obtained from the Marquises of Lunigiana; and as a result he was, as we all know, employed for years to make roads and open quarries for Clement VII. He is said to have quarried even on Monte Altissimo; perhaps—who knows?—to have reached the wonderful Tacca Bianca at its summit. The quarrysmith at the foot of the Altissimo, with whom I had a long talk under the chestnut trees, informed me that before our hospitable French friends, the Heuraux, had attacked the wonderful White Scar in 1870, attempts to quarry it had been made many, many years ago, by "a certain Buonarroti," but that might be merely an old woman's tale, a *favola*. Be this as it may, and despite the complaints in his letters, I cannot help feeling that the great marble peaks and the narrow gorges were a fitter place for Michelangelo than the anterooms of the Vatican. And I would willingly forget all those studio vexations and intrigues, and think of his real life as up here, watching the storms smoking along the crags, or the ships sailing in the sunset in the sea, far, far away across the mountain ridges—a fit successor of Dante's mysterious soothsayer Aruns, who

Had once a cave, among the snowy marbles,
For his abode, whence, when he scanned the stars there,
And scanned the sea, his view was not impeded.

Certainly, the marble mountains, seen from the hills of Florence or from their own seaboard, seem to have haunted Michelangelo's imagination. And if he never put real mountains into his backgrounds, he caught nevertheless, their attitude and, so to speak, their gesture; the weary repose of some, the uneasy leaning on elbow and shoulder of others, the twisting of neck and straining of back and loins, the whole primeval tragedy of effort and triumph and failure of the marble giants, and copied them into his prophets and sibyls and tragic allegoric men and women.

And this—who knows?—is perhaps the greatest service which the marble mountains, which the great Monte Altissimo rising in front of me with pinnacles like a weather-worn cathedral, have done to art. For, alas! the marble—the finest, purest, almost Grecian marble—has come too late in the day. Niceoto and Giovanni Pisano, Donatello and Jacopo della Quercia when they could not get some fragment of an antique column, had only veined, spotty, easily decaying marble to work in, and Michelangelo him-

self does not seem to have employed the finest marble of these valleys, certainly never the marble of the Tacca Bianca. That was reserved for the benefit of contemporary salons and academies. And, meanwhile, there are the men hanging from the crags by ropes, cutting the blocks from the perpendicular face of the mountain. . . . As for me, I feel, as I hear the faint click of invisible chisels from across the ravine, and the rattle of marble debris, and occasional distant rumble of blasting, that the works of modern sculpture, all this dead and dreary art, will have in future a living and wonderful side for me, in the fact of the marble in which they are carved, and the remembrance of the scent of sundried herbs, of the sound of the well-head at the base of the Altissimo, and the sight of the eagle circling above its spectral white crags.

Vernon Lee.

Carrara, August, 1898.

THE "SHIVEREE."



W'Y you don't mean t' tell me 'at you never seen ner *heard*
A shiverree! Well, gemunee! but you *must* be a bird.
I catilate 'ith all the din we made when we was boys
That ever'body then on earth just had to hear the noise.
You fellars in the city, w'y you never have no fun,
You fancy you're some punkins, but you're nubbins, ever' one.
Your theaters an' oppry-plays, they ain't no good to me,
Ten thousand of 'em can't compare 'ith jest one shiverree.

A shiverree's the loudest thing 'at man's invented yit.
It's got more ginger in it an' more real git up an' git,
Fer ever'body but the pair 'at's jest been spliced, they try
To make a racket 'at 'ill lift the roof right off the sky.
The fellers in the mischief ill surround the house as still
As mice; they ain't a sign o' noise ner nothin' like, until,
All of a sudden hell breaks loose, an' nen, oh, gemunee!
The folks fer miles an' miles around knows there's a shiverree.

You take a dozen cowbells an' as many big tin pans
An' lots o' horns an' shot-guns, an' a crowd 'at understan's
Jest how to operate em, an' they'll make, as I have said,
A noise 'at's catilated fur to purt' nigh raise the dead.
These 'ith a dry-goods box er two an' some long, rosined rails
To saw acrost 'em makes a noise whereat the stoutest quails
An' 'at's the sort o' music 'at the hull blame crowd give me
The night 'at we was married an' we had our shiverree.

Nixon Waterman, in L. A. W. Bulletin.

THE LAUREL¹ LIMESTONE OF INDIANA.*



THE Laurel limestone usually occurs in horizontal slabs which vary considerably in thickness, but the variation in thickness lies between rather narrow limits. In the region of Longwood, slabs an inch and a half, two inches, and two inches and a half are very frequent, but these quarries are no longer run on a large scale. In the neighborhood of Laurel the slabs are usually four, five and six inches thick, but layers seven, eight and nine inches thick occur with sufficient frequency to enable the quarrymen to furnish stone also for purposes requiring heavier stone. Some thinner layers, two and three inches thick, also occur, but the characteristic stone at Laurel varies between four and six inches, with only occasional layers of greater or smaller thickness. At New Point the slabs vary chiefly between eight and ten inches, although some of the layers hang together sufficiently well to be quarried into 12 and 15-inch slabs. By a process of splitting or capping some of the layers can be separated into 4-inch slabs. The quarries at St. Paul, Harris City, Westport and Osgood all show layers four inches thick. Layers five and six inches thick also occur. But seven, eight, nine and ten-inch layers are the characteristic layers at these quarries. Moreover, the different layers can be quarried out together more commonly than farther northeastward, so that slabs twelve, fifteen, eighteen and even twenty inches thick may be obtained. Occasionally slabs twenty-three, twenty-four and twenty-five inches thick have been secured from certain layers in some of the quarries. It should be remembered, however, in the case of these much thicker slabs, that they in reality consist of a number of slabs that can be easily split or capped, and that they can not readily be subjected to great pressures parallel to the bedding. When used, however, in position where the pressure is vertical to the bedding these large slabs have proved very serviceable, requiring less handling and not demanding the use of as much cement or mortar in the construction of piers for bridges and other heavy work.

USES TO WHICH THE LAUREL LIMESTONE IS PUT.

In the construction of buildings the thinner layers are used for window

1. The term "Laurel" is used by the author to designate the deposits of Niagara limestone in the counties of Decatur, Franklin and Fayette in southeastern Indiana, sometimes referred to as "Indiana freestone."

*Extracts from the Twenty-second Annual Report of the State Geologist, by August F. Foerste.

sills and window caps. The thicker layers make very good door sills and range stone. Medium sized stone is used for ashlar. Heavy slabs are used for steps and large slabs for landings. Fairly heavy slabs of considerable length and breadth are also in great demand for porticos and porches. For the foundation of ordinary houses the fragments rejected for other purposes on account of their insufficient size are used. Heavy stones are used as footings. It is used in the construction of jails and for sidewalks, street crossings, gutter crossings, curbing and gutter stone. Usually the thinner layers of stone are found to be of sufficient thickness for these purposes.

In the case of bridges the very heaviest stones are used for pier footings, or the very heavy stones placed at the base of piers. Similar heavy stones are used for the construction of the piers themselves. Large, heavy, thick slabs are used as a capping to the piers, and as a support to the ends of the iron superstructure.

The very heaviest layers of Laurel limestone are used for bridge abutments. The heavy stone is usually placed in that part of the abutment which is exposed to the fury of the water during high freshets. Behind this outer surface of very heavy stone the backing of the abutment is placed. This consists usually of riprap and gudgeon, piled in closely and held together by cement. By gudgeon is meant the yellow, soft stone which is usually found forming the upper layers of any quarry, before the regular good quarry stone is reached. In the quarries in the area here under consideration the gudgeon consists usually of thin layers, two to four inches thick, which are likely to be more or less filled with chert or to be at least associated with chert.

Heavy limestone is used for the bases of monuments, and thin layers are used as grave covers, directly over the caskets.

The heaviest layers are used in the construction of milk troughs and drinking troughs.

WHY THE LAUREL LIMESTONE IS ESPECIALLY USEFUL FOR THESE PURPOSES.

The Laurel limestone occurs in the quarry in the form of slabs of nearly uniform thickness in the same layer. Different layers, however, vary considerably in thickness, as has already been described. The upper and lower surfaces of these slabs are so nearly even that where no dressed work is required the stone is already sufficiently smooth on these two faces to be at once used. Even where it is desired to use dressed work the flatness of the upper and lower surfaces makes it necessary to do but little extra cutting there. Stone for almost any purpose can be therefore secured by selecting those layers in the vertical section in the quarry which have the proper thickness, and, after the stone has been quarried, the two faces in question are already trimmed by nature, altogether or nearly ready for use.

More than this, the quarryer may break out the stone slabs in such width that the stone will require scarcely any trimming around the margins of the slab, when being prepared for use.

It is readily seen that any stone which occurs in layers of all sizes, as regards thickness, and which is already trimmed by nature on the two largest surfaces, can be quarried much more cheaply than a stone which is more massive, and which must be first split in order to reach these dimensions. For this reason the Laurel limestone will always be a preëminent stone for use in all cases in which it is desirable to use the stone in the form of slabs of greater or less dimensions. It may be crowded out in part by the cheaper cement, but in any case where it is desirable to use stone at all, the Laurel limestone will be cheaper to quarry, and it will be cheaper to work.

PURPOSES FOR WHICH THE LAUREL LIMESTONE IS NOT SUITABLE.

The Laurel limestone is a hard rock. It is not readily carved. This does not mean that it can not be carved at all. I have seen pillars of stone, equivalent to the Laurel limestone, which have been carved in the most delicate fashion, but it has been hard work. Of course the stone, when once carved, should retain the carved surface for a long time, but carving such a hard stone is too expensive, and for all purposes requiring carving the Laurel limestone will be always superseded by the Bedford limestone in Indiana, and by the Berea sandstone in Ohio.

THE USE OF LAUREL LIMESTONE FOR FINE ARCHITECTURAL CONSTRUCTIONS.

The value of the Laurel limestone for strictly architectural purposes has never been fully appreciated. I do not know of any striking use of the limestone in an architectural way in the entire State of Indiana. And yet it is a stone admitting of excellent architectural effects, when properly handled in conjunction with other materials. In order to justly appreciate the value of the Laurel limestone it is necessary to go to Dayton, O., where the stone equivalent to the Laurel limestone is known under the name of Dayton limestone.

Many of the most striking buildings recently erected in the city show the value of this stone when used in conjunction with other materials. This is especially true of some of the buildings in the residence portion of the city.

The Laurel limestone is a very white rock. This color is usually in strong contrast with that of any other rock. When used with taste the white limestone does much to enliven the appearance of a building otherwise dull and gloomy in appearance. The white limestone usually offers good contrasts with the red color of bricks, and is especially striking when used in combination with pressed bricks. It gives a very chaste appearance to a

building in which the upper story is composed chiefly of light painted wood, the white limestone forming the lower part of the building.

Of course the limestone must be free from iron pyrites, or else the weathering of the pyrites will soon streak the walls of the building with the most unsightly streaks of brown. But this can readily be avoided. There are numerous quarries in the region here described in which certain layers are entirely free from pyrites. Quarrymen furnishing stone containing iron pyrites, when the contract has been for stone free from pyrites, and when they have been informed by the architects that the stone in question is to be used to produce special architectural effects, should have their names published as those of men to be avoided by the entire fraternity of architects; and those who furnish only good stone should be paid a price worthy of their labor and care.

METHODS OF QUARRYING IN USE.

The methods of quarrying in use in many of the quarries in the Laurel limestone are often very primitive. After the quarry has once been opened holes are drilled by means of hand-drills a certain distance behind the front edge of the uppermost layer. Wedges are inserted in the holes thus formed, and a slab of definite width is thus removed. The drill holes are placed in a row parallel to the front edge of the layer, closer together or farther apart, as experience directs the quarrier, the distance being determined by the hardness of the layer being worked.

The original length of the slab is usually determined by the presence of seams which traverse the limestone in approximately parallel directions. After the blocks of stone have been once loosened they are divided into such lengths as are considered desirable.

Some of the quarries at Osgood, Westport, Harris City, St. Paul and New Point have, however, introduced the use of steam drills, and of steam channelers.



PRACTICAL STONE-CUTTING.—X.

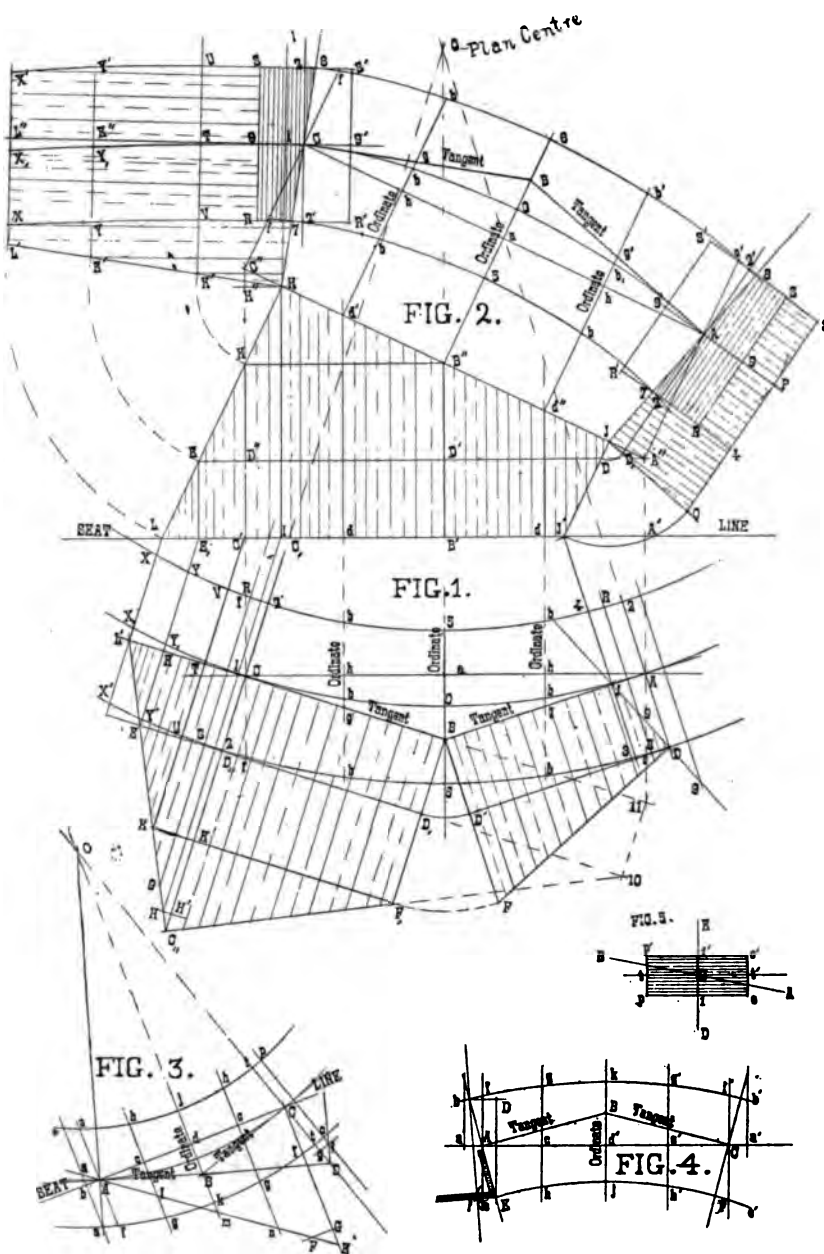
EXPLANATION OF THE CONSTRUCTION OF A REPRESENTATION OF A SOLID, SHOWING THE DEVELOPMENT AND ACTUAL POSITION OF BED AND JOINT SECTIONS, OF A PIECE OF COPING, THE PLAN OF WHICH IS LESS THAN A QUARTER CIRCLE, AND THE RISE OR INCLINATION OF THE SECTION PLANE UNIFORM OR EQUAL OVER THE PLAN TANGENTS.



IN Fig. 1 is shown the plan, the tangents A, B, C forming an obtuse angle. At last example they made a right angle, but at this plan, owing to the radius being of greater length and the center curve less than a quadrant, the tangents are obtuse. Having drawn the plan curves, joint lines, tangents, and the chord lines A—a—C, as directed for the similar operations at preceding model, we will now explain the manner of ascertaining the position of directing plan ordinate. As in practice the center O would be at too great a distance to be advantageously employed for this purpose, a different means must be adopted. As already explained, in order to show the whole of the lower joint surface we have to raise the ground plane above that of the seat line, forming the base of the model. Assuming C—D₁₁, of Fig. 1, as equal to the height desired, draw D'—D₁₀—10, parallel with the plan tangent B—C. Then having produced the joint line O—C, and through B the parallel B—D₁₀—F₁₁, make D₁₀—F₁₁ and D₁₁—K', K'—C₁₁, each equal to the half rise of coping. Then D₁₁—C₁₁ will equal the total rise of coping over the curved plan. Now draw C₁₁—F₁₁, produced to meet D₁₁—D₁₀, produced in 10. Then parallel with B—F₁₁, draw 10—11. Join 11 with A and the position of the level directing ordinate of the plan may be obtained, and as before explained all plan ordinates are drawn parallel with this line. Now at any convenient point at the center plan ordinate, as B', square with the ordinate draw the seat line L—A'. Then in the manner fully explained for the similar operations, at the model last constructed, project C''—A'' the full inclination of the section plane and develop bed section.

Then at Fig. 1 draw the representations of the tangent planes, and through J K E and L, parallel with the joint lines, produce lines meeting the seat line as shown in J' C, E, and L. Now at Fig. 2 to draw the representation of the joint surface over C of plan, parallel with the tangent B—C through H draw H—L'. Then with H as center, rotate K—E—L into

PLATE 9.



$K'-E'-L'$; then with $L'-L$ of Fig. 1 as radius, and L of Fig. 2 as center—describe an arc in L'' ; then with $C''-L'$ of Fig. 1 as radius and C of Fig. 2 as center, cut the arc in L'' . Join C with L'' and the position of the intersection of the tangent plane with the surface of the joint may be obtained. Then in the manner fully explained for the like operations at preceding models, find the points $S'-2-S-U$, etc., and through them trace the elliptical curves of right section of the joint plane. At the lower joint surface, with J as center, rotate $D-J'$ into $D,-C$ at the parallel $J-Q$ with the tangent $B-A$. Then joining $A-D$, and parallel with $A-D$, drawing $Q-P$ produced, the position of the line at which the joint surface intersects the plane of the base of the model may be ascertained. Then find the points $S'-2'-S-3$, etc., and trace the curves of right section as directed above for the like operation at the upper joint surface. Then taking a sharp knife cut clear through the board at the outline of the drawing, following the curved line $a-b-8$, etc., of the bed section. Then cut about half through the board at the lines $8-C-H$, $H-B''-J$, and $8-A-J$ of Fig. 2; and at $L-J'$, $J-B$, and $B-C-L'$ of the plan. Then with the lines on the exterior fold the three sides of the model into their vertical position, and fold over the section planes into their inclined position and the model may be completed. Then as at last example cut full sized joint patterns, these to be made use of for further observation and instruction.

In Figs. 3, 4, 5 are shown the methods which may in practice be employed for the purpose of developing the bed and joint sections. In Fig. 3 O is the plan center, $A-C$ the center curve, and $A-B-C$ the plan tangents. The chord line joining $A-C$ is made the seat line, and as before explained all plan ordinates are at right angles with this line. Understanding this: At the joint line $O-C$ produced, set off $C-D$ equal to the rise of coping over the tangent $B-C$, and joining $B-D$ the inclination over the tangent may be obtained. Then square with the seat line draw $C-E$ equal to the total rise of coping, and joining $E-A$ the full inclination of the section plane may be obtained. Then produce the plan ordinates, as shown in $a-A-I$, etc., and in Fig. 4 set off $a-A-c-d$, etc., equal to those lengths given in $a-E$ of Fig. 3. Then project tangents and curves of section as explained in preceding examples for the similar problems. Then to find bevel: In Fig. 4 parallel with $a-a'$ draw $b-D$; then square with $a-a'$ draw $E-D$. In Fig. 3 make $E-F$ equal to $b-D$ of Fig. 4, and draw $F-G$ parallel with $A-C$. Then set off $D-g$ equal with $E-G$, and draw $g-i$ parallel with tangent $B-C$. Then draw $D-i$ square with $B-D$. Now with $D-i$ as radius and E of Fig. 4 as center, draw an arc at i . A line drawn through b'' tangent with the arc gives the position of a level line at the joint surfaces. This obtained the section may be developed by the

methods already explained for similar problems at other examples, and is shown projected in Fig. 5. We may remark, that when as at this and the preceding problem the rise of coping may be uniform over the tangents, the one joint section is all that is required, as it will do service at both joints by simply reversing its position when applying it. It will be clearly seen at the model that the point 8 of the top joint surface is the highest point at the surface of the section plane, and also that the point 8 of the lower joint surface is the lowest point at the surface of the plane. Then if two moulds have been cut as directed the student will readily see the manner in which the joint sections should be correctly applied. It will be observed that the surface o'—i'—p', of the section of Fig. 5, will be uppermost at its application to the lower joint plane, and reversed—that is lowermost at the upper joint plane. This applies equally at all examples which may have a uniform rise over tangents.

Chas. H. Fox.

FIND THE ANSWERS IN THE "STONES."

THE last word, or the final syllable of the word, that is an answer to each of the lines in the following, is "stone." For instance, the answer to No. 1 is *Livingstone*, the explorer.

Any one cutting out and filling in the list and returning it to us with \$1 in currency, money order, or registered letter, will be listed as a subscriber to *STONE* for one year—October, 1898, to September, 1899, inclusive—thus securing the magazine at half the regular subscription price.

1. I'd a mission to Afric's dark nation,
2. I was a poet obscure.
3. I, a writer of ponderous law books,
4. Old England my fame will insure.
5. I will welcome you first to the homestead,
6. I will furnish a path in the street,
7. I will keep your fair name in remembrance,
8. I help make the shoes for your feet.
9. I stand for the well-wrought foundation,
10. And I the grand arches make strong.
11. I furnish the finish to temples,
Made famous in history and song.
12. I'm the center of pleasant home circles,
13. I make a safe place for your feet,
14. I'm the jovial miller's assistant
In grinding the corn and the wheat.
15. I'm famed for my power of attraction,
16. I can sharpen the tools that you send,
17. I can measure the distance you travel,
18. And I to your pavements am friend.
19. I'm prized by the makers of jewels,
20. I come with the snow and the sleet.
21. I'll take off the ink from your fingers,
22. And print with it a book hard to beat.

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ASTOR, LENOX AND
TILDEN FOUNDATIONS

CEMENTS AND LIMES.

Inexhaustible Cement Supply.

It is stated that the deposit of cement discovered near Owen Sound, Ont., and the manufacture of which was begun in 1889, is proving practically inexhaustible, and the daily capacity of the factory will soon be increased to three hundred barrels. The prevailing price is \$2.10 per barrel of 350 pounds net. The product is claimed to be fully equal to the English, German, or Belgian article, and, it is said, will eventually take the place of importations to Canada at least.

Cement and Sulphur.

For fixing bolts in stonework, a German publication recommends a mixture of sulphur with Portland cement, in the ratio of three to one, as superior to either individual constituent.

The Fire Resistance of Structural Iron.

As a building material iron or steel is in many respects far superior to wood. It is true that the former is exposed to destruction by rust, but the visible parts can be kept free from rust by painting them with a suitable material from time to time. The invisible, or rather inaccessible parts, can also be protected in a like manner at the start, but such coats of paint cannot be considered permanent preventatives of rust.

Experience has shown, says W. Sims, in an article in *Stahl und Eisen*, that the best protector for structural iron is cement. By exposing pieces of iron which had been imbedded in cement for a long time, it was proven that rust cannot assail iron thus protected, provided the

cement surrounds the iron on all sides and so that no hollow spaces exist between the latter and the cement coat. Slag cement would not be suitable for the purpose, as it contains acids. The expectations entertained from the application of iron as a fireproof building material have only been partially fulfilled, however. In the beginning it was believed that by the exclusive use of iron in connection with other refractory materials, the problem of erecting actually fireproof buildings had been solved. The destruction by fire of numerous iron and stone buildings, however, which were deemed fireproof, showed that they had no claim to this distinction. They often fell in shortly after the outbreak of the fire. The collapse, as was later ascertained, was due to the fact that the metal parts, then mostly cast or wrought iron, had lost their carrying power. It was recognized from this fact that something had to be done to protect the iron from the direct action of the fire, so as to prevent its loss of carrying power and expansion. That the carrying power of cast and wrought iron decreases at higher temperature was shown as early as 1886, but the city government of Hamburg was the first to have exhaustive tests made which corresponded in every respect to the conditions met with in a great conflagration. These tests included cast and wrought iron as well as wooden supports.

The supports were placed upright into an iron frame, and hydraulic pressure, amounting to about 15,000 pounds per square inch, put on. For heating the supports a furnace, lined with firebrick and provided with gas burners, was used. The furnace consisted of two parts, ar-

ranged on an upright shaft; the two parts could be closed and opened at will. The supports passed through the furnace so that a little space was left between support and top and bottom of furnace, permitting the introduction of air from below and exhausting the gases of combustion above.

It was shown that unprotected iron supports lost their carrying power in from seventeen to fifty-nine minutes, according as the heat was increased faster or slower. Supports filled up with mortar or trellised showed hardly any better results, but proved again the necessity of incasing the supports by a fireproof or non-conducting material. The duties of the latter are to delay the advance of heat to the iron, and to possess sufficient strength to resist the shock of falling debris and the attack of the stream of water thrown by a fire engine. In the subsequent tests the supports were incased in slabs of plaster of paris, xylite or stone-wood, asbestos cement, etc. The results were remarkable. Provided with such casing the iron supports retained their carrying power for as long as 3 hours and 56 minutes. An oaken support without casing withstood a similar pressure in the fire for only 1 hour and 21 minutes. The heat of the flame at which the tests were made ranged between 1,100 and 1,300 degrees centigrade.

The new works of the Peerless Portland Cement Company at Union City, Mich., will soon be turning out cement at the rate of one thousand barrels per day. The works cover about six acres of ground in the city, the raw material, mud and clay, being brought in from a distance of several miles by means of a railway and tramway owned and operated by the company. Three hundred hands are employed and the output of the works for five years to come has been sold.

Lime Fertilizer.

Discussion of the effects of lime on soils still goes on. Many farmers are more familiar with its use than with commercial fertilizers. Experiment stations are

devoting a good deal of their work to the consideration of lime and every year new and important facts are brought out. The government has issued a special bulletin on "the liming of soils," by Prof. H. J. Wheeler, and the Rhode Island station has discovered that for some crops lime is a special fertilizer. Lime has been used for hundreds of years on the soil, its action being direct and indirect. It is deficient in granite, mica schist and sandstone soil; hence on such soils lime is of "direct" value in supplying a necessary element of plant food. Lime is of "indirect" value in unlocking the unavailable potash, phosphoric acid and nitrogen in the soil, and exerts a decided influence on the mechanical condition of soils, rendering heavy, compact soils looser in texture and tending to bind particles of loose leachy soils. One of its important functions is in furnishing conditions in the soil favorable to the activity of the micro-organisms that convert the nitrogen of organic matter into nitrates which are readily assimilated by plants, which decompose organic matter, and which assist leguminous plants to assimilate the free nitrogen of the air. Gypsum, the sulphate of lime, has been demonstrated to be a most effective corrective of black alkali found in some soils of the arid regions.

The cement war was still on at Louisville, Ky., Sept. 5, and the price of cement had dropped to 40 cents per barrel. The former price was from 60 to 80 cents.

Concrete Railway Fence Posts.

Concrete posts for right-of-way fences are attracting considerable attention among railway engineers. The posts are rectangular in section, slightly tapering from the base toward the top. Experiments have shown that the best concrete for this work consists of one part of the best Portland cement to three parts of clean, sharp sand, and sometimes the proportion is made as low as two and one-quarter to nine. One barrel of this cement will make from eighteen to twenty posts of a size suitable for railroad fences. The posts are cast in wooden

molds, through which No. 10 two-wire cables under tension are run from top to bottom, so that the cables become imbedded in the concrete. Four cables are used with the line posts, one near each corner, while eight cables are used in corner and gate posts. The cables are to hold the parts together should the posts be broken. Concrete line posts cost from 15 to 17 cents each, and corner posts about 54 cents each. The Chicago Record says a railway engineer who has carefully considered the use of concrete posts is of the opinion that when made with care and of good material their life might be twenty-five years, or even more, as they are not subject to decay, are not injured by fire and will not rust.

Cement Factories in Russia.

The Black Sea Cement Company's output during the year 1897 was about 64,820 tons, valued approximately at \$1,065,000, while that of the Franco-Russian Cement Company, at Ghelendjik, was about 48,400 tons, valued at about \$850,000. During the last few months the necessary capital has been obtained for the construction of three other factories in the immediate neighborhood of Novorossisk, on the Black Sea, and there should be an opportunity for the introduction of American machinery.

A plant for the manufacture of Portland cement from furnace slag is being erected by the Clinton Iron and Steel Company, of Pittsburg, Pa., adjoining their furnace. The buildings and machinery will cost \$150,000.

Kingston, N. Y.—The cement mills in this locality have experienced a very dull season, Beach's mill being about the only one which has been operated to its full capacity, and it has been so busy as to turn over some of its orders to other mills, but cement has been sold at a very close figure. This mill is now constructing a railroad which parallels the Wallkill Valley railroad from the works to the bridge crossing the canal and creek. It is expected to be in operation this fall. The cement is now hauled by team from the mill to the canal. Many of the other mills have only been operated three and four days a week. There is only a small amount of cement stored and, at the present writing, the prospect for an active fall season seems good. A few of the mills are now running more days in the week, and the indications are that business activities of former days will soon return to the cement localities.—Argus, August 25.

The seventeenth cement mill in Clark county, Indiana, is to be built, the projectors being the Schelbrede family and Pittsburg capitalists. The present output of cement is being sold by non-association firms at less than cost. In carload lots it brings but twenty cents a barrel. Three sacks equal a barrel, and the paper costs seven cents. Commission men, it is said, receive three cents for each barrel sold. The estimated cost of producing a barrel of cement is nine cents, leaving a margin of one cent for the manufacturer. It is understood one mill and perhaps others will retire from the field within a few months.

How Mica is Obtained.

The mica trade is controlled practically by three or four large concerns in New York, Chicago and Boston. These houses have an agent who buys for cash whatever mica is brought by the miners. They control the market, and fix the prices to be paid to the miner, as well as the prices for which it is sold in the markets.

Mica, it need hardly be said, is a very valuable, almost precious, mineral, and those who are obliged to buy a small strip for their stove doors will testify. A package worth hundreds of dollars can be carried in a basket slung over the arm, or in a pair of saddle-bags on horse-back. When prepared for the market the solid block, as taken from the mine, is split into sheets. These are cut into squares or rectangles of almost every possible size, from 2x2 inches up to 8x10 inches, and sometimes even larger. There are no less than 183 regular sizes kept in stock by dealers.

The mining of mica is the poetry of mining. It is impossible to conceive of a more exciting and fascinating employment. The vein of mica-bearing quartz, lying between rocks of different formation, has been found. The cap rock has been blasted away. Little "nigger heads"—small lumps of crumbling mica mixed with slate and other rock—are growing plentiful. The rock is carefully examined by the experienced miner, and all indications are that mica will soon be found. A blast is made. The rock and debris is cleared away, and there in the bottom is a block of the precious stuff, a ragged corner showing itself black and glittering in the white quartz in which it is imbedded. With the tips of the fingers the miner gently and affectionately brushes away the dirt and small stones which partly cover it. Its thickness is carefully noted, its position in the rock is learnedly discussed, and many a speculation indulged in as to its size and quality. The hole is quickly drilled, the small blast is made, just loosening the rock, and all eagerly crowd around as one of the men with his pick pulls away the broken stone. There it lies, a black,

glittering mass, nine or ten inches across its face, three or four inches thick, and irregular in shape, as all blocks of mica are. A good-sized block, and, if solid and of perfect cleavage, will be worth several dollars. The excitement is not allayed, however, and will not be until the block is split open and we know how it looks on the inside. It is a very bad thing to split open a block at the mine, and contrary to all rules, for there is danger that the fine, polished faces will be scratched.—Age of Steel.

Improved Artistic Effects in a Cemetery.

"One of the biggest improvements our beautiful Lexington cemetery has ever known was the departure of the lot fence," says a well known Lexington gentleman who looks to artistic effects and the eternal fitness of things. "Another feature, and one that seems to be steadily growing in favor is now noticeable. It shows itself in the disposition to devote one central stone or monument on a lot to record purposes, viz.: To concentrate on one single memorial the various inscriptions and epitaphs pertaining to all the dead on a lot instead of erecting additional monuments and large headstones for that purpose, the headstones being then unnecessary. Each grave is designated by a low marble or granite 'marker,' or small headstone inscribed with nothing but the name of the sleeper there, and footstones are omitted entirely. A New York gentleman who went through the cemetery the other day was struck with this arrangement. He said: 'If this idea is only half way carried out it will add greatly to the beauty of this cemetery. Just think how much unnecessary stone work is erected by affectionate relatives and friends when too much afflicted to consider the matter. I know of a small lot in a cemetery near New York City that contains three high monuments, any one of which would be ample for all the dead on the lot if it was suitably inscribed and little markers were used, and in addition there are twenty-two big headstones that would not have been needed at all if ample inscription space had been reserved on the

sides of one of the monuments for the purpose. By this new arrangement as the number of stones will be reduced the lots will be improved in appearance, will afford more space for future use, can be much more easily kept in order, and the beauty of the cemetery be correspondingly and greatly increased.'"—Lexington (Ky.) Leader.

Pottery Produced Electrically.

An English firm has developed an electric process for the production of ceramic wares, which is stated to produce a very superior product. Photography is employed to produce the designs, and the electric furnace for burning. After the photograph has been applied to the material the photograph is put under a specially prepared glaze and burnt in. A great deal of the beauty and success of the system depends upon the use of the electric furnace, due to the regulation of its high temperatures. A representative of a London electrical paper who examined several specimens of this ware pronounced them excellent, and gave his opinion that the process can be applied to all kinds of ware with commercial success, as it is not costly.

Massachusetts Marble Business.

Prospects are brighter for the marble industry in southern Berkshire. Some time ago a large quantity of stone was taken out, but the quality became poor and the industry nearly died out. Recently experts have been employed and they have sunk drills to various depths, and find that the indications point to large deposits of fine marble, and it is believed it will pay to uncover. The Goodale quarries, which are the oldest in the southern part of the county, have recently been reopened at some distance from the original location, and a very satisfactory quality of marble is being unearthed. Parties from Philadelphia have been sinking drills in various places to ascertain the quality of stone.

A fine quality of marble has been found near the station at Ashley Falls, and work is now going on at the Baldwin

place, about two miles from Great Barrington, where the depth of seventy feet was recently reached. It is proposed to sink the shaft one hundred feet if the vein reaches that depth. Thus far the core taken out shows that the marble improves with the depth of the vein. It is nearly white, with just a tinge of blue, very close grained, and takes a high polish.

Norcross Bros., who have bought a big quarry at Glendale, opened work a few weeks ago with a large force.

The String-Course.

String-courses admit of great variety and contribute very much to decoration, while they are in themselves essential members, inasmuch as they serve to define the internal division of the building, corresponding with the floors of the several stories; and by separating one tier of windows from another, to mark each as a distinct portion of the general composition, complete as regards itself, though secondary to the other. While they separate they serve also to connect and combine the successive stages of a building, and to produce a due mixture of horizontal and perpendicular lines. In Gothic architecture the upper surface of a string-course is almost invariably splayed or sloped in order to shoot off rain, the projection being usually such that the wet would else lodge upon it. The string-course itself consists sometimes of only a few narrow and plain mouldings, at others of a variety of them separated by one or more considerable hollows. In the later or perpendicular style of Gothic the string-course is frequently made a broad tablet, not only richly molded but ornamented with sculptured blocks, heads of animals, shields, etc., placed at intervals in the principal cavetto or hollow, besides which additional carved ornament is occasionally introduced on the surfaces between the other mouldings. In some instances the string-course is so enlarged as to become a sort of frieze or horizontal panel filled up with a pattern of tracery, or with lesser panels, etc., carved on it. In Italian architecture the string course (*fascia*, Italian; *cordon*, French; *band*, German)

is either quite plain or more or less decorated, according to the character of the floor to which it belongs. That which crowns a basement floor is seldom more than a plat band or plain surface, while the upper ones form ornamental fascias, enriched with guilloches, frets, etc., either with or without moldings.

Limestone is Mineral.

At a recent sitting of the Supreme Court of British Columbia, the point at issue was whether limestone was a mineral within the meaning of the law and consequently whether limestone could be held and staked as a mineral claim.

Justice Drake held that limestone was a mineral and could be located under the mineral act, where it was not "mined" for building purposes.

Stone for Public Buildings.

Every new building erected by the state ought to be made of stone, and native stones at that, unless there is some special reason for using either brick or wood, says the Cedar Rapids (Iowa) Republican. The state already has too many cheap looking buildings. At Iowa City, for instance, there is only one real substantial looking building in the State University collection of buildings and that is the old capitol of Iowa. That building was made of stone. It lasts well and has always looked impressive and will continue to look so. There is not a brick building there that looks as well or as imposing as the old capitol. Brick is not impressive in a public building.

The State of Iowa is too great and too rich to tolerate any more makeshift buildings. It must begin to build for the future as well as for the present. Its buildings must be standing one hundred years from now.

The difference between stone and brick for public buildings can be seen in this city by comparing the high school building with any of the other school buildings. The difference is apparent to all observers. The Cedar Rapids high school building is one of the finest looking

structures of its kind in the state. It was built of Iowa stone. It will always look impressive. It will last indefinitely and it will be a pride and joy forever.

The State of Iowa does not want to fool away any more money putting up wooden or brick buildings. There is only one material fit for public buildings and that is stone. It is to be hoped that the new Historical Building* at Des Moines will be constructed out of solid granite.

A Stone-Cleaning Composition.

Joseph W. Finerty, of Milford, N. H., has recently received letters patent for a stone-cleaning composition, which is particularly adapted for marble and granite. The invention is a simple and inexpensive compound for removing all acid, dirt, and iron stains, as well as discolorations, from granite or marble, also for cleaning monuments that have become mossy or stained from exposure to the weather or the drippings from trees, and also for cleaning the exterior of buildings. The compound, it is said, will not of itself stain or discolor granite or marble. The composition is made of the following ingredients: oxalic acid, one pound; chlorid of lime, one pound; nitric acid, two drams; water, twelve ounces, mixed and made into a paste. In the manufacture of this paste or compound the oxalic acid and chlorid of lime is mixed together and thoroughly pulverized. The water and nitric acid is then mixed and added to the oxalic acid and chlorid of lime, all being mixed together until they form a homogeneous paste, in which form it is put up for use.

The paste is applied to the surface to be cleansed and allowed to remain until it has thoroughly drawn out the discolorations, when it is removed by washing with a brush.

The patentee admits that some of the ingredients mentioned have been used in conjunction with other agencies in cleansing compounds; but he was not aware that before his invention the composition of matter herein shown and described had been known and used as a cleansing compound for granite or marble.

The chief ingredient or base of this compound is nitric acid. This element and the oxalic element constitute the cleansing agent, which, in connection with the other ingredients, make a perfectly harmless cleaning paste for granite and marble. It is said it will quickly and effectively draw out iron and other stains without any injury to the surface to which the paste is applied.

Trap Rock Masonry in India.

The indigenous pattern for trap masonry for houses, temples, village bunnia's (grocer's) shops, etc., is to split a roundish boulder, of a foot or more in diameter. The split planes are then made the bases, and four segments of each half boulder are knocked off by a twelve-pound hammer, faced with a blunt steel chisel imbedded in it, called a sutki; thus two pyramids are obtained. In building a wall these stones are laid with the pyramid bases in the front and rear of the wall, the apex of each stone is propped up by chips, the interstices are freely filled with chips and mortar, or even mud is used, or well kneaded clay. This dog tooth pattern, of course, has little or no bond; such walls, however, stand for great heights for centuries, but if once split longitudinally, or bulged, they soon collapse. For a given surface area of wall, these pyramids—some call them bread seals—require only one-third the quantity of stone required in a solidly built wall. The bed joints are generally only half an inch or so wide from the face of the wall. It will be readily seen that a difficulty arises in building the salient corners of buildings. The difficulty is got over either by using square stone or by rounding the corners with a radius of two or three feet. This is the general method adopted in corner buildings—the round is carried up one story and then the rounded corner merges into a square corner. Mullick Umber, the water works engineer of Aurungzebe, adopted the use of pyramidal stones. His works are characterized by rough masonry depending on the goodness of the mortar.

For bridge work trap is broken by

splitting, heavy hammers being used. A hammer arranged guillotine fashion does not seem to have been tried. It would be very effective in splitting large stones for arches, corner stones, etc.; especially if a weak line was made across the intended line of cleavage with a diamond-pointed chisel, which is the chisel par excellence to use on trap rock. The cleavage surfaces are sometimes fairly true planes with not much wind or twist in them, but most frequently the fracture is conchoidal. In hammer-dressed masonry this gives rise to very thick, unsightly joints, unsuitable for abutments of girder bridges, but not so detrimental to arched bridges—where the resultant of the arch thrust and weight of the abutment lies well within the heart of the wall, which is differently built. In thick face joints, when a stone transmits pressure to the stone below, principally by a convex surface, it is noticed that the free mortar, not exposed to pressure, will shrink as much as one-eighth of an inch in an inch of thickness. The adhesion of mortar being greater than the cohesion, one would expect the mortar joint to open or fissure along its center, but in face work the mortar exposed to the sun and wind dries before setting. Again, the stone may not be quite clean, may be dusty. These considerations led an experienced engineer friend of mine to adopt the plan of filling the heart of a wall with large shapeless stone not laid close together by hand from one end of the wall to the other, but placed at random, madness with a method; a sort of herring-bone pattern is good. The stones in a course may touch here and there, but the interstices should be large enough to enable the stone ballast concrete being well rammed in. The tamping can be done by ordinary coolies and should be kept up some time, till the exuding moisture dries up and the mortar concrete shows signs of setting. Water poured into such work will not run through the wall, but it will through hammer-dressed trap, built in mortar alone, with a trowel and without the tamping. Finding the above to work well and being very economical, six masons built a single course of 1,000 cubic

feet, laying the face stones of abutment, wings and return walls in a day, assisted by coolies to carry the stone and mortar and concrete for the interstices.

The application of the above to arch building is, build in the ordinary way up to the haunches, then lay the remaining courses dry, spaced by small chips, fill in with very fine broken stone concrete one-fourth inch to one-half inch size and tamp between the arch stones with a flat bar of iron two and one-half feet long, two inches wide and three-fourths of an inch thick, provided with a wooden handle. The shaft of the bar should be riveted through the handle. The bar dropping off the handle onto the mason's toes might produce tetanus. This pattern may be called "*Sans Voussoir*."—Henry W. Allen, C. E., in *Indian Engineering*.

Stone Road Construction.

Though truth is great and will prevail she often takes some time about it. Unfortunately many men think rather of immediate advantage than any more ulterior blessing the triumphing of truth might bring. Wise in their generation, it is not at first that they attack an inconvenient truth; thus in three well-marked stages is the battle fought. At first some truth on enunciation stands admitted and undisputed; but when its novelty has worn away those who would benefit by its rejection grow bolder, and at last announce, as a new truth, what they would wish to be; and it is not until this, too, has served their purpose for a time that both their rival statements meet on even terms. In that fair field the righteous one must win.

It has been once or twice suggested that mankind should club together and erect a mighty monument to Adam, to whom, as truthfully remarked, we all owe—under Providence—our being. The reason why the hat has not as yet gone round rests probably on the conviction many hold that we owe also—under Providence again—our fall and modicum of human ills to that same gentleman's backslidings. Surely a monument, however, should be erected to our forefathers' linear descendant, MacAdam, not only

for his demonstrating that broken stone pressed and compacted would cohere together, and by the mutual friction of its parts bear and distribute heavy pressures as well as if it actually were the smooth and solid slab it seems, but also for his statement that road metal should be as clean and free from clay as a good mason would desire his mortar.

Specifications which insist on this are not attractive to contractors. Clay generally is of lesser cost than stone and also fills with readiness all vacant spaces, so that a smooth appearing surface is with a minimum of labor brought about. It did not, therefore, take such interested parties long to summon courage and assert with boldness that clay was wanted and that clay was good. It was not difficult, moreover, to bolster up with evidence their dictum; for it is easy so to lay a road that without clay the metal will not bind.

Clay mixed with ballast nearly halves the friction and makes the mass less capable of bearing heavy loads. Moreover, clay when wet or dry varies considerably in volume. Roads which contain it in their mass rut badly in wet weather, however thick the metalling may be. If clean stone, not all of one gauge, but mixed with all sized stuff in due proportion, be rolled upon a good foundation, a sound and perfect road is made, without the mixture of an ounce of clay. Such roads, though meant for heavy traffic, stand well with half a foot of metal. If well drained they are not affected by wet, which surely renders plastic roads laid with thicker dirty stone. If owing to imperfect mixing or wrong proportion in the size of metal, something is wanted to correct the fault; "clay may be added to a very small extent, but this must be upon the top alone and in the form of dry clay finely powdered."

Coarse sand forms excellent foundation. When, as is frequently the case, this is much cheaper than the metal, it is most foolish to lay metal only. On a firm clay, for instance, first provide for drainage; then shape the bed, cutting it down below the sub-grade some six inches, fill in with coarse sand or fine gravel, let all be shaped as is the finished

road to be, then roll and well compact the filling, upon which four to six inches of assorted stuff, if clean, will form a better road than eighteen inches ordinary metal clay "bound" or clay adulterated. —Indian Engineering.

Certain Rights of the Contractor.

The average building contractor is so accustomed to look out for himself, and, we must admit, is so perfectly able to do so, that we do not always bear in mind some of the rights which are undoubtedly his, but which are very often not insisted upon; and the scramble for work, especially in these dull times, is so pronounced that we imagine an architect can easily fail to appreciate how much it means for a contractor to be spending his time week after week figuring new work, none of which may come his way. There have been at different times a few spasmodic attempts to so alter the present system for making tenders for work that there would be an opportunity for some compensation to be awarded to unsuccessful bidders. At one time it was proposed that each of the contractors who were invited to figure should add a certain percentage to his bid, the one to whom the contract is awarded to divide this percentage among the unsuccessful contestants. One of the strongest of the trade associations in this city has, if we are rightly informed, carried such a scheme into practical effect for a number of years with eminently satisfactory results. But as this particular association limits its work to a technical portion of building operations and includes in its ranks practically all who follow this line in this city, it is easier to regulate such a practice than it would be in the case of the general contractors, who often have to compete with every one, and on all sorts of terms and conditions. It would really be fair than when a contractor is called upon to spend several days in carefully estimating the cost of a structure, the owner, who thereby gets the benefit of selection from several bidders, should be willing to pay a small compensation for the opportunity, though just how this can be

brought about is a question which is not easily solved. There are a few considerations, however, that would certainly lighten the task of the unsuccessful bidder, without laying any serious burden upon either architects or owners.

It ought to be an inflexible rule with an architect that no contractor should ever be allowed to change his bid after it has once been submitted in writing. If the builder is to feel that the owner, by applying moral suasion, can expect him to cut off five, ten, or fifteen per cent. he will, if he is human, add that amount to his bid in the first place, and take his chances on being the lowest, and it is believed that by adhering strictly to a rule of this sort the architect would get lower bids in the first place, and would take a higher rank in the opinion of the competitors.

Another slight act of courtesy can make relations much more pleasant. Ordinarily when a builder submits a tender for work he thereupon goes his way and may not know for weeks, or even months, who is to do the work. Just as soon as any decision is reached, one of the bidders ought to be notified that the contract has been awarded to so and so under certain conditions, and appreciation expressed of the services of the bidder in figuring. This is not money compensation for estimating, but it is a matter of courtesy between the architect and the builder, which one owes to the other. The architect cannot build a building without a builder, though the builder might put up a structure without an architect, but anything which brings the two more closely together is of unquestionable advantage. The line between architect and builder is at best a faint one, and the amenities of civilization can well be studied as a branch of architecture. —The Brick-builder.

Bedford's New Cut-Off Stone Road.

The final details for the building of the Indiana Stone Railway were completed by Judge Field August 10, says the Bedford (Ind.) Mail. Condemnation proceedings were filed against those who did

not accept the amounts allowed by the appraisers, and it is the intention to begin the work of construction at once. It is stated that the contract for the grading has been let to L. T. Dickason, of Chicago. The hope is to have the grading done before cold weather, when it will be easy enough to lay the ties and iron. The road is ten miles long and will cost \$165,000. There are sixteen bridges, and it is the intention to make this part of the road the main line from Clear Creek to the Cleveland switch just north of Harrodsburg. This will cut off the heaviest grade on the road and will also leave out the town of Smithville. The Monon has thoroughly investigated the stone and is satisfied that the investment will be one of the best ever made by the company in the returns of heavy freight traffic. Judge Field states that the company paid an average of \$100 per acre for all the land through which the road passes.

The increase in our foreign trade in roofing slate has been a great boon to the producers, and has kept our quarries in full operation during the past year. The total exports for the twelve months ending June, 1898, were valued at \$1,370,075, as against \$780,112 for the twelve months ending June, 1897, an increase of nearly 75 per cent. The exports for the month of June were \$132,006, as compared with \$78,479 in June, 1898.—Pen Argyl Index.

Modeling in Clay.

The practical value to the mechanic of some acquaintance with the art of modeling in clay is not fully understood. To know exactly how a piece of work will look when finished is frequently a material advantage in executing it, and it often happens that an adequate idea cannot be obtained from an ordinary working drawing. In such cases the mechanic who can make a rough model in clay, of the work, is placed at a material advantage. Whenever the form of the work cannot be properly appreciated from drawings, a clay model is of the greatest service. The material is cheap, easily

manipulated, and can be used over and over again.

The clay employed for the purpose of modeling is the ordinary pipe clay used by potters. It should be selected as free as possible from stones and other imperfections. In getting it ready for use it should first be chopped by means of an old hatchet, or even a piece of band iron, and sufficient water added to it to render it soft enough to hold well together, but not enough to make it sticky. Care should be taken to make it uniform in consistency throughout, and if some quantity of it is required for the work in hand, it should be formed into the shape of bricks to facilitate handling. When the clay is not required for some time it should be covered with some coarse sacking, and water occasionally sprinkled upon it from a watering can, to keep it in condition. If it should get dry it is sometimes better to take it to a pottery and get it passed through the grinder before using.

Modeling in clay is practiced in several trades, but in none sufficiently, and perhaps it is of more service to the worker in stone or in granite than to any other. It is easy enough to model roughly in clay the whole front of a building to a small scale. This is of inestimable advantage to those responsible for the proper carrying out of the work. It frequently happens that difficulties arise in the reading of a drawing, however carefully plans, sections, and elevations may be prepared. These difficulties at once become apparent when a clay model to scale is prepared, and it then becomes easy enough to get over them. This is especially the case when different varieties of stone are used on the same building, some of which may, by the necessity of the case, be worked by one set of workmen, and some by another. No two workmen may read some particular point of a drawing alike, but no mistake can be made if all work to casts of the same model.

It is easy enough with a very little practice for an average skilled workman to model in clay sufficiently well for all practical purposes of his particular trade. To begin with, the best tools to use are

the hands, but assistance may be had in paring off the clay by means of a piece of wire turned into the shape of a triangle, with the end turned out to form a handle, one side being ground down to an edge. A regular set of modeling tools should of course be used for more delicate operations. These tools are made in a number of shapes and sizes, and the number of them required will depend largely on the character of the work in hand. No portion should be finished off until the whole is of the shape desired. In cases where the model is a large one and requires several days for its completion, it will be necessary to cover the clay with wet cloths to prevent it from getting dry and cracking. By such means it may be worked upon for an indefinite period.—The Stonemason, England.

F. C. Davis, of London, England, has purchased a large tract of quarry land for an English syndicate of Cadwaldaer Jones, on Scotch Hill, near Fair Haven, Vt., and is negotiating for other quarry land in this section. It is understood that the syndicate is to put a large sum of money in the slate business in this section and will give employment to several hundred men. Mr. Davis is satisfied that this is to be the future slate producing section, and is purchasing all the valuable quarries he can find.—Poultney (Vt.) Journal.

New Slate Ledge in Minnesota.

Levi Dietz, a slate quarryman of Carlton county, Minnesota, has made a new discovery of fine blue or blue black slate. His samples were taken from a newly found ledge, exposed by the cut of the Great Northern road, and situated on the southwest quarter of the northwest quarter of section 30, 49, 16, about three miles from the village of Cloquet.

Mr. Dietz says the ledge appears to be about two hundred feet wide, and has been traced for a distance of more than a quarter of a mile. The slate splits evenly and has a beautiful cleavage. It is essentially pure—90 per cent.—and would be unequalled for roofing or tiling purposes or for mantels, and could not be

excelled for school slates. There is a big demand for slate of good quality, and there appears to be an unlimited supply on the Dietz property, which embraces about two hundred acres.

Mr. Dietz says that he recently made a thorough examination of the new discovery in company with a slate expert from Belgium, and as a result both he and the expert are of the opinion that there are great possibilities in the property for a big slate quarry.

Negotiations are pending for a sale or lease of the property to Henry Miller, of Chokio, Stevens county, Minn., a man having sufficient capital to develop the property. Slate quarried in Pennsylvania or Vermont and shipped to St. Paul is expensive. The freight amounts to \$3 a square, which would be 50 cents in excess of what it would cost to ship from this vicinity. A square of good quality slate brings \$6 and upward anywhere.—Duluth Tribune.

During the month of August 296 carloads of roofing slate were shipped from the Pen Argyl, Pa., quarries, over the Bangor and Portland railway. This was the heaviest business in any month in the last four years. The nearest to it was in October, 1895, when 279 carloads were shipped.—Index.

The Albion quarry, Pen Argyl, Pa., produced 1,795 squares of roofing slate during the month of August, working seven shanties. This was the largest amount of slate ever made by seven shanties at any quarry in that section.

The Fidelity quarry, Pen Argyl, Pa., produced 1,350 squares of roofing slate in August. Their shipments were in fair proportion to their production.

Granville, N. Y.—S. Weinburg has bought land of John F. Williams, near the quarries of Norton Bros. and Owens Bros., on which it is thought there is valuable slate deposits. Consideration, \$3,000.

OUR FOREIGN TRADE IN STONES, ETC.

From the monthly summary of finance and commerce of the United States, corrected to Sept. 2, 1897 we compile the following:

ARTICLES.	JULY—				SEVEN MONTHS ENDING JULY—			
	1897		1896		1897		1896	
	Quan.	Values.	Quan.	Values.	Quan.	Values.	Quan.	Values.
Imports—		<i>Dollars</i>		<i>Dollars</i>		<i>Dollars</i>		<i>Dollars.</i>
Cement (lbs.):								
Imp. from—								
United Kingdom.....	16,492,181	54,825	12,054,188	41,166	65,550,600	911,314	37,096,518	126,158
Belgium.....	30,321,290	64,411	24,906,080	52,017	115,650,757	335,111	141,391,289	412,482
France.....	1,186,872	3,454	.....	.....	5,309,073	16,749	2,094,000	7,798
Germany.....	50,988,075	164,937	47,174,078	107,990	259,392,025	837,185	219,917,706	728,612
Other Europe.....	1,014,314	3,164	1,926,432	5,295	10,286,568	38,670	13,525,516	47,736
British North America	177,500	800	220,000	1,136	836,225	3,904	1,054,550	5,359
Other countries.....	.....	.....	.....	.....	411	1	5,900	67
Total.....	90,180,181	291,591	86,368,718	287,594	456,925,719	1,442,934	414,392,774	1,229,097
Marble, and mfrs. of		41,913		51,291		572,090		410,363
Stone, & manufactures		24,300		16,689		151,962		120,462
of, including slate.....		66,213		67,980		724,042		540,725
Total.....								
Exports—								
Marble and stone, and								
manufactures of:								
Unmanufactured.....		15,122		7,153		44,370		45,584
Manufactures of—								
Roofing slate.....		111,178		124,132		575,733		802,465
All other.....		41,331		28,154		287,016		267,374
Total.....		167,630		159,439		907,119		1,105,423
Cement.....bbls	9,581	16,608	2,161	4,951	33,504	60,749	21,454	41,616
Exports foreign mds.								
Cement, Roman, Portland								
etc.....lbs	11,662	59	323,765	826	891,641	3,935	2,552,996	9,706
Marble, & mfrs. of.....						3,455		1,564
Stone, & mfrs. of includ-		58		122		10,062		2,156
ing slate.....								
Total.....		58		122		13,517		4,720

Merchandise Remaining in Warehouse on July 31, 1897, and 1896 Respectively.

ARTICLES.	July—			
	1897		1896.	
	Quantities.	Values.	Quantities.	Values.
Cement, Roman, Portland, etc.....lbs..	5,007,363	\$ 11,441	3,449,317	\$ 9,961
Marble and stone, and manufactures of:				
Marble, and manufactures of.....		1,769		37,859
Stone, and manufactures of, including slate.....		1,973		9,864
Total.....		3,74		47,443

Commerce the United States with the Dominion of Canada for 1896 and 1897.

ARTICLES.	YEARS ENDING JUNE 30—			
	1896.		1897.	
	Quantities	Values.	Quantities.	Values.
Imports—		<i>Dollars.</i>		<i>Dollars.</i>
Cement, Roman, Portland, etc.....(lbs)	4,533,511	20,892	2,749,425	11,454
Marble and stone and manufactures of:				
Marble and manufacturers of.....		452		264
Stone and Manufacturers of, including slate.....		40,407		50,764
Total.....		40,859		51,023
Exports—				
Marble and Manufactures of:				
Blocks from the quarry in the rough, or sawn on two				
sides only, and not specially shapen—				
Containing 15 cubic feet and over.....		19,522		13,673
Containing less than 15 cubic feet.....				
Slabs sawn on not more than two sides.....		33,915		23,814
Blocks and slabs sawn on more than two sides.....		4,784		4,894
Blocks and slabs, finished.....		10,045		7,961
Marble and manufactures of, other.....				
Slate and manufactures of:				
Man'els.....	2,421	334	1,235	14
Roofing Slate, black or blue, when split or dressed only,				
squares.....	470	6,274	321	3,694
Roofing slate, red, green, or other color.....squares	182,516	1,074	352,359	1,318
School and writing slates, porcelain, drawing, etc.....No		4,99		6,460
Slate pencils.....		616		362
Slate of all kinds, and manufactures of, other.....		6,068		6,770
Stone and manufactures of:				
Building stone, except marble—				
Granite and freestone, dressed, and all other.....tons	13,964	40,880	8,005	24,363
Granite and freestone, rough, etc.....tons	870	3,084	940	4,398
Flagstone, sawn or dressed.....ton			13	237
Grindstones, not mounted, etc.....tons	1,735	22,634	1,330	21,019
Manufactures of, other.....		16,356		12,515



TIMELY TOPICS

Quarry Statistics. From the general report on mines and quarries of Great Britain for 1897, Prof. C. LeNeve Foster, editor, the following statistics relating to the quarrying industry are given: Total number persons employed in or about quarries during 1897 was 123,370, or 10,541 more than in the previous year. Number of quarries worked, 6,922. Of the employes 58,845 males and 8 females worked inside the actual pits, holes, or excavations, while 64,525 males and 1,462 females were employed in and about the workshops outside. Nearly one-half the real, or inside, quarriers were engaged in producing sandstone and limestone, 10,506 granite and other igneous rocks, and 5,175 slate. The female quarriers were distributed among quarries, in England 1,237, in Wales 33, in Scotland 192, in Ireland 4, and in Isle of Man 4. The report is a mass of statistics relating to accidents, prosecutions, mortality, etc., among quarriers, and from which logical deductions are drawn by the editor and other investigators of experience in the industry. And looking over this remarkable work, we are impressed with the great importance of such compilations annually. In our country we wait ten years and more to learn what has taken place in the practical operations of the industries, and then only get a partial exhibit. In Great Britain the apparently inconsequential matters are inquired into and reported upon, and these round out a complete report such as we are stranger

to in this country. It would be well for the quarrying industry in America, for instance, if the matter of causes for accidents were inquired into by a commission other than a coroner's jury. If scientific investigation were made of the natural faults more or less common in all quarries, and laws compulsory on the operators to provide every safeguard against accident, the hazard to life and limb would not be so great as now. Most of the disasters common in quarrying operations are clearly avoidable under wise precaution, but no law defines these or compels the operator to adopt means to insure safety in the dangerous operations. As rigid inspection of quarries should be made as is now made and contemplated for mines. The disasters of a year in the quarrying industry would show an appalling report were such made by government authority.

Making a Life Mask. In this issue of *STONE* is an interesting practical and illustrated article, telling how to make a life mask. The writer is Mr. Harry Turner Hems, who represented his well known father, Harry Hems, the Exeter sculptor, of England, at the latter's exhibit in the British section of the Manufacturers' Building during the whole year of the World's Fair. He will no doubt be remembered with pleasure by a large number of our readers. Hems, Jr., is well able to record, not only the details of the operation, but the feelings of the subject also, as he, too, has gone through the ordeal.

The chief point of interest in this article, perhaps, is that, in the whole history of the annals of art, this is the first time the details of life-casting have been clearly illustrated through the medium of the camera. In Plates Nos. 1, 2, 3, and 7 our readers will find portraits of Harry himself, while in illustrations Nos. 1 and 3 admirable pictures of his equally talented and lively brother, Mr. Greville C. Hems, also occurs. The "subject" was Mr. Archibald Morgan, a valued and skilled member of Messrs. Harry Hems & Sons artistic staff, and son of Mr. Morgan, the prominent resident clerk of works at the venerable old Cathedral of St. David's in South Wales. The photos were taken by Mr. Wilfred P. W. Hems, Mr. Harry Hems' fourth son.

The Good Roads Movement. The people in the country districts in many sections are being educated to the advantage of good roads by exhibits of road-making at the county fairs, this fall. This is a commendable move. It ought to be adopted by every district, county and state fair board in the country. Nothing the people need so much, and know so little about, as good roads and how to economically make them. STONE has made the suggestion to manufacturers of stone crushers that here is their opportunity not only to sell machines, but to do a splendid service to the people at the same time. Instead of simply showing at the fairs what their machine can do at crushing and separating stone, let them build a short stretch of stone roadway of the very best construction competent builders can put down. The builders of road rollers and scrapers would, no doubt, share in the expense. The lesson thus imparted would be a standing advertisement that would pay immeasurably. At the Minnesota state fair this month the idea of building a model highway has

been put into force, and expert road builders give daily practical exemplification of best methods of doing the work. The same line of work is being done in other states.

The Man and the Machine. Mr. Gorse makes an urgent plea in this issue

of STONE for the "good of the order" of skilled workers in stone, that will evoke sympathy for the craftsmen whom he represents. The article does not present any sound argument against the practical advantages of the modern stone-working machine. The stone planing and molding machine was inevitable at the moment this type of machine was demonstrated successful on wood. Its introduction into stone yards was demanded for several reasons—firstly, the competition of terra cotta, brick and cement; secondly, the interminable wrangling between employer and employe over wage rates and shop rules; thirdly, the machine multiplied capacity and minimized cost of output, thus making it nearer possible to compete with stone against the cheaper building material mentioned. Its advent was hastened by the aggressiveness of the walking delegate. There isn't any doubt about that. The same forcible reasons that brought it into use will keep it in the equipment of the modern stone-working plant.

The machine is a good deal like the man at the same kind of work. It can be made to injure stone by careless handling, but it has not, so far as we have learned, any inherent cupidity, like the disgruntled stone-cutter often discloses. It makes no mistakes; it does no damage for which it is solely responsible, to the stone; it is built to do a defined quality of work only. Much has been said against its fitness, but the criticism fails of substantial proof so far. It has not yet been perfected to the point that it excels the workmanship of the

skilled artisan, but for the work it is constructed to execute it is, mechanically, almost perfect. Inasmuch as a double machine has the capacity of a dozen rapid men, it is certainly economical. STONE has not yet observed any evidence in support of the statement that a properly handled planer "burns" stone. This seems to be the principal bugaboo conjured by the opponents of the machine. No doubt a planer can be made to "burn" the surface of stone just as it can be made to burn the surface of wood, but there is no reason why the machine should be made to do it. The assertion that the planer "stuns and shakes" the stone, and is, therefore, chargeable for its early decay, is not to be entertained in view of the prior influence of the blast or the channeler. There is a good deal of nonsense in the "shake" theory of stone disintegration anyhow. There's nothing short of utter ruination that an incompetent or malevolent workman may not do to any material in process of formation by machine or under hand. The fact that a machine does good work outweighs criticism that it is not adapted for the work it has been constructed to perform. The fact that a stone-cutter ruins a block of stone doesn't fix the responsibility in the hammers or chisels he employed to commit the act. We apprehend Mr. Gorse and those who antagonize the stone-working machine will have to find other reasons than these for moving for its displacement.

There's an honest reason, a humane reason, and these conjointly make a sound reason, why hand-cut should be preferred above machine-cut stone by the builder and his architect—and that sound reason is fully and eloquently set forth in Mr. Gorse's article. Every man owes recognition to the needs of his fellow-man. The machine that displaces men who cannot get away from its baneful

shadow exerts an unhappy influence on mankind. It is not sufficient argument that a few other men have been provided with work in building that machine. The incentive is destroyed to qualify men for masters in the arts and industries, when the inventor and machine builder are solely relied on to provide the means for doing the work of the world, which willing hands, guided by intelligent brains, should do. It seems to us that is the better way to look at this question of labor-saving machinery. Let us not too eagerly adopt means that make misery. Let men reason together, and that applies to the oppression by those organized, as well as to those who yield only when the power of their money fails.

A Good Law. It is not widely known outside the legal fraternity, that the State of New York was given a law on April 30 last, that should be confirmed by every state legislature in the land. It is a law to "regulate the sale of merchandise and to prevent misleading and dishonest representations in connection therewith." In other words, a law to punish lying. There is no greater evil in the business life of to-day than what has come to be known as "the department store method" of advertising and merchandizing goods. We have no fault to find with the department store idea, for in a sense every mercantile or manufacturing concern that makes or handles more than one grade of goods, is of the department store class, in a lesser form. But the method by which the big department store entices the public is notoriously obvious to every one. They do it by "misleading and dishonest representations." That statement will stand without annotation. But it is not only to the department store that the law referred to applies, but it covers the case of the manufacturer who says in his ad-

vertisements that his machine is what it is not or his wares what they are not. It applies to the stone trade as well as to the clothing trade. The full text of the law which is now in force in New York State is as follows :

An act to regulate the sale of merchandise and to prevent misleading and dishonest representations in connection therewith. Became a law April 30, 1898, with the approval of the governor. Passed, a majority being present.

The people of the State of New York, represented in Senate and Assembly, do enact as follows :

SECTION 1. Any firm, person, corporation or association of persons, or any employe of such or any of such, who in the newspapers or other periodicals of this state, or in public advertisements, or in communications intended for a large number of persons, knowingly makes or disseminates any statements or assertions of facts with respect to his, its or their business affairs concerning the quantity, the quality, the value, the price, the method of production or manufacture, or the fixing of the price of his, its, or their merchandise or professional work; or the manner or source of purchase of such merchandise; or the possession of awards, prizes or distinctions; or the motive or purpose of a sale, intended to have the appearance of an advantageous offer, which is or are untrue or calculated to mislead, shall be guilty of a misdemeanor.

2. This act shall take effect immediately.

The Struggle for Wealth. One listens nowadays to a good deal of lamentation over the hopelessness of the man of little fortune as he struggles against the influence of aggregated wealth in the mercantile and manufacturing lines. "The man with two or three thousand dollars who starts in business to-day has but little prospect of success, no matter how progressive or up-to-date he may be. * * The large capitalist and the larger combinations of capital have almost completely blocked the highway to even a modest living by the small dealer, the small manufacturer and the small mine owner," says an industrial exchange. We wonder if that is true, or the editor was just in from an interview with "the man who stopped the paper?" If there is one thing more than another that riles the bile in the ver of the trade journalist, it is the act

of the unappreciative tradesman who "turns down" his trade journal. STONE is of opinion that the editor who wrote the lines we have quoted is really more seriously disturbed over personal affliction than over the calamity he imagines has come upon the "ninety-nine in one hundred cases." He fails to observe that it is always the small dealer who grows into the big one; the small manufacturer who swells into the rotundity and height of the monopolist; the small miner who digs and delves until he strikes a "pocket" rich, as a score of bonanzas. Why not charge it to laxity or bad luck as reasonably as to charge it to lack of opportunity, why the man with a couple of thousand capital fails of success? STONE is not wise enough to show clearly why the small capitalist will sometimes succeed and sometimes fail, but the fact that some do succeed seems ample proof to it that success is not contingent altogether on the license of the large capitalist. The man who is built for success in any undertaking will get there in spite of everything. That will be conceded, we think. The per capita of wealth is greater to-day than it ever was in this country; the consumption of everything essential to the life of the individual is greater, per capita, than it ever was. From this it would not appear that the big fish will ever have belly enough to hold all the "smaller fry." We fear our friend, and those who suffer in his alarming, forget that "the man with two or three thousand dollars who starts in business to-day," is much better equipped for adding largely to the sum than were nine out of ten of the millionaires of to-day when they started. If he doesn't succeed it is not the fault of anybody but himself. STONE has authority to utter this opinion "seein' as how" it is of the "small fry," but of great expectations.



THE CONCRETE MONUMENT.

Some time ago we received a sample copy of *STONE*. Later we received a letter from you asking for a description of our work. This we are glad to give you. This is a patent process. We manufacture tombstones and monuments out of concrete composed of cement and pure grain sand mixed and wet to a stiff dough. We place enough of this mixture in the mould to fill it one or two inches deep, then pound this down thoroughly with a mallet or a press. Then a layer of gravel is placed in and another layer of the mixture is pressed in, and so on until the mould is filled. The sides of the mould are then removed and the stone is polished with a trowel, using dry cement to put on a smooth surface. Any coloring matter may be used with this dry cement to give it an imitation of white, blue, or clouded marble. The stones placed in the middle are no disadvantage, for in breaking a slab in two when a stone is in the way it will break also, and a part will stay with each piece of the slab. It will break before it will pull out. This shows the great strength of the work.

After the monument is molded it is let stand until hard enough to handle. About twelve hours is long enough. It is then submerged in a vat of pure, clear water, where it remains from three to fifteen days owing to its size. This seems to temper it, as water will temper hot iron. It is then taken out, and is still made whiter by sprinkling with water and allowed to dry several times. In this way we can make a stone that will imitate marble so much that a close inspection is necessary to detect the difference.

We are able to manufacture this and sell it from one-third to one-half the cost of marble. It seems to stand the heat and cold much better and does not corrode or turn black like most cheap marble after a few years. This work seems to bleach out whiter all the time and does not admit of a growth of rock moss.

MISSOURI CONCRETE CO.

Bloomfield, Mo.

CLEVELAND, O.

Trade in this city at the present writing is very dull. Fully 25 per cent. of the stone-cutters are idle just now, and there is nothing to warrant us in saying that we will see a good fall. There is nothing coming out that will benefit us.

Some day Cleveland will have a new city hall, Mayor McKissen having announced the

following gentlemen to serve on the city hall commission: Messrs. Thos. W. Hill, Stephen C. Gladwin, M. F. Bramley, Nathan I. Dryloos and Frederick W. Gehring. Mr. Gladwin is a member of the stone-cutters' union and represents the building craftsmen on the commission. About \$1,500,000 will be spent for a new city hall.

GEORGE.

BALTIMORE, MD.

There has not been much improvement here in the building line. There is a nice fire department truck house in the market and also one or two school houses.

Granite seems to be prevailing very much in the city now. There are several good jobs of it now going on. There is considerable granite cutting being done by the government at Fort Carroll outside of Baltimore. The stock has been in the fort since the days of the civil war and is now being "worked up" in order to make the fort more modern.

You remember the columns of the Baltimore court house you gave a description of in *STONE*. A second one is broken. This is a very unfortunate occurrence, as the exterior of the building is about completed, and this delay in waiting for another column is not pleasant to the contractors. This column was about half finished; the preceding one was finished and was broken in hoisting into place.

Our building inspector is in favor of adding another story to our present city hall in order to give more room. This building has been standing about twenty years and is of Beaver Dam marble. I would like to see a plan adopted whereby the square to the south of the present building would be bought and an addition of the same size and design made to it, having the two buildings connected by arching Fayette street. This would probably cost a million or a million and a half dollars, but I think would be well spent, as even with the addition of an extra story to the present building it will not be many days before even that will not be sufficient for the many departments.

The stone masons and stone-cutters are also busy, as are the soft stone and marble workers, owing to the unusually large number of stone buildings going up in the city.

WILKERSON.

DAYTON, O.

Bids were opened last month for the construction of two new school buildings, costing respectively \$34,000 and \$45,250. The cut stone for the first was awarded to L. H. Webber for \$2,450 and the other to H. E. Talbott for \$2,387.

Ed Ryan has been awarded a contract to straighten the channel of the river and the construction of flood proof levees north of this city. The contract requires the completion of the work on or before Nov. 1. Stone for the abutments of the new bridge over the river is

being hauled to the ground. It is said the bridge will be one of the finest in the country. Its cost will be about \$20,000. D'ONOFRIO.

MILWAUKEE, WIS.

Things are running along smoothly here, with nearly all hands working in the building line.

The Board of Public Works opened bids August 30 for paving Wisconsin street with brick. The award was held back pending a test of brick offered.

C. W. Sevelly is to build a house in the near future; stone trimmings.

LEYDEN, N. Y.

A big stone job was recently let in the northern part of this state to the J. B. Gillespie Company, of Pittsburg, Pa. The job consists of digging a waterway about three miles long, building two railroad bridges and building a power house 650x160 feet, and 60 feet high. The object is to furnish electric power for the surrounding towns. Consideration is over \$1,000, and the stone-cutting on the railroad bridges have been sublet to O'Connor Bros., of Chuamont, N. Y. I think the Gillespie company will do its own work on the power house. If so, there will be lots of work for the stone-cutters for some time to come. DYGART.

PEORIA, ILL.

Things are quiet in the building line in Peoria at present, but now that the war is over it is hoped that old-time prosperity will return.

The Westminster church contract was recently let. The structure is to be of brick, with Bedford stone trimmings, and is to cost \$20,000. Mr. Wade, of this city, secured the contract.

The asylum job is in process of construction, but the indications are that the stone will be shipped in here cut.

There is talk of another school coming out this fall. SCALLY.

ROCHESTER, N. Y.

Work has picked up considerably in the stone-cutting line since writing to you last, but a great part of it is for out-of-town buildings. One local firm has secured the stone work of the buildings being erected at Sonyea, N. Y. (Craig Colony); another local firm has the cutting of the asylum buildings at Rome, N. Y., and together with the work in the city we have not an idle stone-cutter in town. MCELROY.

Our Imports of Marble.


The importation of marble to the United States has almost ceased. It is only now and then that a cargo arrives at this port, while a few years ago a fleet of sailing vessels brought many cargoes annually from the famous Carrara quarries of Italy to Philadelphia. Marble buildings seem to be becoming things of the past, and the tombstone makers find little demand for marble tombs, slabs or monuments. Granite has taken the place of marble everywhere, even in the cemeteries, where marble shafts and slabs were formerly the only proper things. Granite, unlike marble, does not require very frequent cleaning and looks well without being touched up for years. It also admits of a high polish and does not show the marks of rust by contact with metal, as marble does.—Philadelphia Record.

The imports of marble, crude and manufactured, amounted in 1896 to \$808,030, in 1897 to \$860,659, and for the twelve months ending June 30, 1898, was \$689,454, with imported marble remaining in the warehouse on last date, of value \$45,034, or a total of imports for last fiscal year of \$734,488, which disproves the statement of the Record that "the importation of marble to the United States has almost ceased."

A strike was inaugurated on Sept. 5 by the employes of the Old Bangor, Bangor Union and Bangor Excelsior slate companies, the three largest concerns in the Bangor section. These firms have very large stocks of slate on their banks, aggregating tens of thousands of squares. On Sept. 1 they notified their employes that a reduction of ten per cent. in wages would be made. The men refused to accept the reduction and struck. The Old Bangor employes held a meeting and appointed a committee to call on the officials. They met the superintendent and were told the reduction could not be avoided because of the condition of the slate market. The three companies combined employ about 1,200 men. Indications are if the men do not accept the reduction the quarries will be closed down indefinitely, says the Pen Argyl Index.

SELECTED MISCELLANY.

Concernin' Sin.



SIN, so they say, is man's great foe;
By jing, I sort o' doubt it,
Fer, drat my pictur', I don't know,
What earth 'd be without it!
An' while too much is not so nice,
A little bit won't hurt you,
Fer, I maintain, 'thout some vice,
There couldn't be much virtue.

Now, s'posin' everyone you know,
An' all yer friends an' brothers,
Was all percisely thus an' so,
An' good as all the others?
W'y earth 'd be, you'd soon find out,
One long, dull, dreary level,
If no one ever went about
A-stirrin' up the devil.

The sight that makes a saint feel glad
Is jest a few good samples
O' folks distressed fer bein' bad,—
Some "horrible examples."
An' less we keep a few on hand
To illustrate our teachin',
We'll have to close our churches and
The preachers give up preachin'.

By closer tendin' o' my fields
I find, fer all my labors,
I'm gettin' bigger, better yields
Than is my lazy neighbors.
But still the pleasure 'd be small
To see my crops a-grown'
If crops grewed jest the same fer all,
Regardless of the hoein'.

An' so I say some shades o' wrong
A-lurkin' in yer system,
But serve to make a feller strong
A-fightin' to resist 'em.
Fer while the saint all sin destroys
An' walks jest to the letter,
The sinner all the while enjoys
The hope o' doin' better.

—Nixon Waterman in L. A. W. Bulletin.

What the War Will Have Cost the United States.

The maintenance of garrisons in the indefinite future, after the conditions of peace have been permanently fixed, may not be chargeable directly as a part of the cost of the war, but will be one of its necessary consequences. It will be interesting to consider the probable amount of both actual war expenses and garrison expenses up to the close of the present fiscal year on June 30, 1899. It will then have been determined whether the Philippine Islands are to remain in the permanent possession of the United States, and it will be time to charge garrison service to our new dependencies and the increase of the navy to the permanent cost of the new foreign policy which may then have been adopted. If the direct war expenditures were \$91,000,000 at the close of July and will be \$25,000,000 more at the close of August, it is probable that they will have increased by \$45,000,000 more during the two months of September and October. This will make the direct cost of the war—lasting for less than four months, but involving heavy expenditures for more than six months—\$161,000,000.

The charges for garrison service for the eight months from the close of October to the close of June cannot yet be stated with precision, because the President has not yet determined how large a garrison will be required in any of the former Spanish colonies. It is a reasonable estimate, however, that 25,000 men at least will be required in each of the three leading colonies—perhaps a few less in the peaceful island of Porto Rico and a few more in Cuba or the Philippines. Nearly all of this force will be in excess of the former strength of the regular army, which will be returned to its frontier and coast stations. A part of the service will be performed by the regular army because of the increase of its membership from 25,000 to 61,000 men, but the net increase of force

above the old peace establishment will probably be 75,000 men and may be greater. The navy will also be considerably increased over the peace footing of a year ago, and will call for larger expenditures for officers, men, coal, and incidental equipment. It is hardly probable that these expenses, including those for the civil government of the colonies, can be kept much within \$15,000,000 per month. For eight months this would add \$120,000,000 to the amount already charged to the direct cost of the war, and would make its incidental cost up to June 30, 1899, \$281,000,000. It may cut a little below this, but in any case will hardly fall below \$250,000,000.—From "Cost and Finances of the Spanish War," by Charles A. Conant, in the American Review of Reviews for September.

Modern Wars Are Brief and Decisive.

The war between Spain and the United States was ended on August 12, having run a course of less than four months. All recent wars in which important members of the world's family of nations have been pitted against each other have been of a short and decisive character. Last year's war between Turkey and Greece began April 17 and was terminated by a truce preliminary to a final peace treaty at the end of four and a half weeks. The Greeks had thought that their superior navy and the *esprit de corps* of their people would offset the great superiority of the Turkish army. But the Greek fleet accomplished next to nothing, and the invasion of the Turkish army was irresistible. The war between Japan and China showed the great superiority of the Japanese both on sea and on land, with the result that a war which began on July 25, 1894, was ended by the utter defeat of China after eight months. The great war of Russia against Turkey, which began April 24, 1877, came to an end with the Russian army lying just outside of Constantinople nine months later. The Franco-Prussian war, which began July 23, 1870, found the Prussians making peace at Versailles on January 28, 1871. Bismarck's war of 1866, in which Prussia made an attack against Austria, lasted only seven weeks. Civil wars and insurrections have a tendency to drag on for a longer time; but all the circumstances and conditions of modern life are favorable to brevity and positive conclusions in wars between distinct nations. Nineteenth century life is practical;

and nations have lost the habit of fighting on and on merely to gratify a false sense of pride, or out of considerations of hatred and revenge. The cumulative force of precedent has helped to make it the established rule of modern statesmanship to seek peace with a public adversary on the best terms possible at the earliest moment when it is clearly apparent that the fortunes of war can have no favorable turn. To fight on when there is no hope of victory is to commit national suicide. Modern public opinion—at least in all countries having parliamentary institutions—acts forcibly and sensibly upon questions of this sort. It is not that patriotism is a waning motive in the hearts of men, but that other motives have come to play a greater part than in former generations.—From "The Progress of the World," in the American Monthly Review of Reviews for September.

Bicycles on a Gravestone.

There is no record that the bicycle has hitherto figured in sculptured work on memorial stones in grave-yards, and, according to a London newspaper, a young widow of Rio de Janeiro may be accounted a pioneer in using its presentment for that purpose. She was introduced to her late husband while out wheeling, and ordered the sculptor to depict the meeting, bicycles and all, on the marble gravestone in alto relievo. The effect is described as more novel than artistic, especially as the lady is chiseled as attired in rational costume. In the inscription, which is in Spanish, is a sentence which may be translated: "My dear soul had the tire of his life prematurely punctured."

Tarred Macadam in Road Construction.

A. H. Campbell, the city surveyor of Canterbury, England, says that roads almost as smooth as asphalt and capable of sustaining any kind of country traffic, may be built at an annual cost of fifteen cents per square yard of road.

This road expert has been for years experimenting with a road material which he calls tarred macadam, and the result of these experiments is the above remarkable statement. Broken stone and tar form the basis of the roadbed composition, which when properly laid by an expert engineer, becomes very smooth and practically weatherproof. Such a road bed costs about \$1.08 per square yard and

when once laid withstands the ordinary wear to which a road is subjected for seven years. This brings the annual cost of such road building down to Mr. Campbell's figure of fifteen cents per yard per year.

In preparing the materials for the road, Mr. Campbell states that the stone after being broken should, before the tar is applied, be heated to a temperature such that the palm of the hand can bear the touch of it. The stone when properly broken is screened through screens of three different sizes, one allowing pieces of from one to two inches square to pass, another allowing only pieces of from only one half inch to an inch square to go through, and another which allows only fragments of less than half an inch square to be screened. The coarse material is used to a thickness of about four inches for a bottom layer, the medium size forms a middle layer nearly an inch thick, and the finest screenings are used as a coat just as thin as can be used, and yet sufficiently large to fill crevices in the roadbed. Screenings of even smaller fragments are then scattered broadcast over the road and traffic commenced upon it at once, in order that the top dressing may be well worked into the tarred material for which it forms a covering. A roller similar to a street roller rolls each separate layer of the road until the proper thickness of the layer has been reached.

Building for Earthquakes.

According to Professor Steere, earthquakes the usual accompaniment of volcanic activity, are too common in the Philippines to be remarkable, unless they tumble one's house about his ears. The light, basket-like dwellings of the natives, perched upon poles, sway about like cradles during these strange movements of the earth and are often thrown out of perpendicular, but are rarely destroyed.

The stone buildings of the Spanish, though usually built of light volcanic rock or of coral, and with thick walls and low stories, and projecting buttresses to protect them from earthquakes, are frequently thrown down. Spanish Manila, the old walled town, the only city in the archipelago built of stone, has suffered most, and some of the streets are still blocked by the ruins of the great earthquake of 1880. In 1863 the city was nearly destroyed, and at frequent intervals since its foundation it has suffered loss of life and property.

In the provinces buildings of stone are rarely found, those existing being generally the churches and conventos, or priests' houses. These have been built by the untrained natives and with no other architects than the priests themselves, but are strongly built and rarely fall. Several times, while being entertained by these hospitable priests, we have been startled by the cry of "Temblor;" when all would rush out of doors to be out of the way of falling walls, and after a few minutes' waiting would return to take up our dinner or conversation where we had left it.

Greek Masonry.

What must be observed in the edifices of Greece is the high finish of all the parts. In them the object, which is not intended to be seen, is wrought with as much care as the exterior composition. The junctures of the blocks which form the columns of the Parthenon are so perfect as to require the greatest attention to discover them, and they leave a mark no thicker than the finest thread. In order to attain this extraordinary perfection, the marble was first reduced to its proper shape by a chisel. Afterwards the two pieces were rubbed one upon the other, and sand and water thrown upon the center of friction. The courses, by means of this practice, were placed with incredible precision, and this precision in the shafts of the columns was determined by a square pivot of olive wood. The roses, the plinths, the moldings, the astragals, all the details of the edifice, exhibit the same perfection. The lines of the capitals and the fluting of the columns of the Parthenon are so sharp, that you would be tempted to suppose that the entire column had passed through a lathe. No turners' work in ivory can be more delicate than the Ionic capitals of the Erechtheum and the Caryatides of the Pandroseum are perfect models.

Diamond Mining in South Africa.

Regarding any reported discovery of a new diamond mine, one of the first questions asked is, "Is it a pipe?" because if so, there is every reason to be assured of its permanency. The "pipes" are roughly circular or elliptical in section, and several hundred feet, sometimes one thousand feet, across. Contrary to the once common belief, there is very seldom a basin-like depression or other change in the surface topography to indicate their existence.

The ground forming the top of the "pipe" is, for about the first thirty yards in depth, usually of a light yellow color, due to the decomposition of the "Kimberlite," or diamondiferous rock, and is called "yellow ground." "Blue ground," in which the Kimberley and De Beers mines have been working for years past, is the hard, unoxidized and unhydrated diamond bearing rock of the general tone of color indicated by its name. It requires drilling and blasting, like any other hard rock, but the impression that diamonds are thereby crushed and broken is erroneous. The fracture is more often due to passage through the fine rolls in the washing operations rather than to blasting. Upon exposure to air this rock changes to a gray color, and disintegrates and crumbles, especially after moistening with water.

To this fortunate characteristic is due the existence of the extensive "floors" at Kimberley, containing millions of tons of blue ground in all degrees of weathering.

The floors are divided up into spaces, four hundred yards by two hundred yards, and on these the blue ground is deposited for a depth of about ten inches. The only treatment to which the flat "veldt," or prairie land, is subjected previous to receiving the "Kimberlite," is to be stripped of grass, bush, and any loose stones. Formerly it was rolled hard and smooth, but this is not now done.

The first operation the Kimberlite undergoes is that of harrowing, the harrows being drawn back and forth between two traction engines, stationed several hundred yards apart, thus avoiding the packing that would take place if the blue ground were traveled over by a steam harrow. After a proper interval, the next process is that of winnowing, or collecting the lumps of hard "blue" that will not disintegrate into heaps. Portable tracks are laid down and the lumps are sent to the crusher house.

A second harrowing then takes place, and if no rains have set in the deposited ground is wet by a hose, a complete system of water pipe being laid over the "floors" for this purpose.

After another interval, to allow of further weathering taking place, the material is loaded into cars on movable tracks, run to the main haulage, and sent to the washing machines, any remaining pieces of hard "blue" being stacked separately and sent to the crushing and concentrating mill. The floor is then ready for a fresh deposit from the mines.

The entire cycle of operations takes about a

year for the De Beers blue ground, sometimes less than this when rains are more frequent. The Kimberley blue ground disintegrates in half that time. The floors are fenced about with barbed wire fencing, and are continually under guard, the night watch being aided by a system of well arranged arc lights.

On July 1, 1897, there were lying upon the depositing floors of the Kimberley, De Beers and the newly-started Wesselton mine an amount of 2,576,694 loads of diamond rock, equal to 2,061,355 tons. At a moderate estimate this tonnage contains over £3,000,000 worth of diamonds, and it also represents a very large amount of capital invested in the mining and transportation of the material.—Thomas Haight Leggett, in *Cassier's Magazine* for September.

Working the Big Guns.

In manning the batteries on a vessel of war twelve men are allotted to every gun with the exception of the ten, twelve and thirteen-inch, mounted in turrets. In the latter case, the guns being mounted in pairs, twelve men are divided between them. Each man has a certain duty to perform, and, under the thorough system of drilling in the United States navy, he is generally letter-perfect in his work. The six men of the thirteen-inch crew are designated as follows: captain, first plugman and sponger, lift-man, return-lever man, trainer.

The duty of the captain is to exercise a general supervision over the crew and to handle the hydraulic rammer. The first plugman and sponger has his station at the rear end of the plug platform, and the second plugman and sponger at the front end of the plug platform. By the plug is meant the piece of steel used to close the breech. The liftman attends to the lift-lever, the return-lever man to the return-lever, and the trainer turns his attention to the lever controlling the hydraulic training gear. In drill and in action everything runs like clockwork, each man seeming a component part of an intricate piece of mechanism.

The great guns are aimed by means of "range finders"—instruments invented by naval officers for the purpose of divining the range of an enemy. One used to a considerable extent in the service consists of two telescopes, placed one at each end of a base line (some measured length of the vessel). These telescopes are directed upon the target, the distance of which

determines the angle between their axes, thereby varying the resistance of two conducting bodies, and causing the deflection of a galvanometer, which is graduated in yards, so that the distance may be read off directly. The working of this finder is so simple that enlisted members of the crew are sometimes stationed at it.

From the foregoing the reader can easily understand that placing and fighting the battery in a modern man-of-war is a science in itself. It is a mistake to imagine that all is smooth sailing and perpetual holidays in Uncle Sam's navy. In fact, the naval officer of the present day must embody in himself the learning of a college professor, the scientific skill of an expert, the courtesy of a Brummel, and the dash and bravery of a D'Artignau.—From "A Warship's Battery," in Frank Leslie's Popular Monthly for September.

Memorial Columns.

The idea of employing a column for a public memorial was probably derived from Egyptian obelisks. It seems to have been first adopted by the Romans, but neither manifests much invention nor regard to propriety. An obelisk is evidently complete in itself; is not intended to bear any support or to be kept steady by it, but is calculated to stand by itself. A column, on the contrary, is only a member of a structure, detached from which and from its entablature it has no meaning nor any particular grace, being apt to look tottering and "top-heavy." It is chiefly as forming a lofty and conspicuous object that a single colossal column recommends itself as a triumphal monument, yet such general outline might be preserved without adhering to the precise shape and details derived from examples from any one of the Orders. In this respect Trajan's Pillar is not so great an architectural solecism as many of the numerous columns professing to be in imitation of, or "after" it, because, owing to its shaft being entirely embossed with sculptures, the ordinary column character is done away with, and a degree of variety and magnificence is produced which may be allowed to silence the objections of criticism. There certainly was something poetical in the idea of making the shaft which bore the emperor's statue record his conquests and military exploits; and the sculptures themselves are not only superior specimens of Roman art, but

highly interesting and valuable as historical documents of costume.

At the same time they serve to make evident how very ill the surface to which they are applied is calculated to display them; for, instead of being extended horizontally, this vast bas-relief is coiled spirally from the base to the summit, so that the figures on the upper part of the shaft can hardly be made out, nor can those on the lower one be viewed consecutively without going round and round the column. This historical poem, as it has been called, addresses itself therefore more to the imagination than to actual inspection.

Stone in Judea.

The hill near Jerusalem where the crucifixion of Jesus occurred is formed of limestone. The shores of the Dead Sea are lined with pumice stone, showered out of some volcano that destroyed Sodom and Gomorrah, which cities finally sank beneath the waters of the Dead Sea.

The Population of Continental Europe

Is given by "La Revue Francaise de l'Etranger" as 380,000,000, made up as follows:

European Russia and Finland.....	106,200,000
Germany.....	52,300,000
Austro-Hungary.....	43,500,000
The United Kingdom.....	39,800,000
France.....	38,500,000
Italy.....	31,300,000
Spain.....	18,000,000
Belgium.....	6,500,000
Turkey in Europe.....	5,800,000
Roumania.....	5,600,000
Portugal.....	5,000,000
Sweden.....	5,000,000
Holland.....	4,900,000
Bulgaria.....	3,300,000
Switzerland.....	3,000,000
Greece.....	2,400,000
Denmark.....	2,300,000
Servia.....	2,300,000
Norway.....	2,000,000

The density per square kilometer, which is about equal to 0.386 square miles, is: Belgium, 220; Italy, 169; Holland, 149; England, 126; Germany, 97; Switzerland, 73; France, 72; Austria, 69; Spain, 36; Russia, 20. While the annual increase of the population of Russia has been 1.45 for every 100 in the last ten years, that of Germany has been 1.15, of Austro-Hungary 0.96, of England, 0.35, of Italy 0.45, of France 0.08. If this rate is continued, the populations at the end of one hundred years will

be : Russia, 228,000,000; Germany, 106,000,000; Austria, 79,000,000; England, 65,000,000; Italy, 44,000,000, and France, 40,900,000.

Counterpart of Marble.

Hans Hirsch, a Chicago sculptor, has just succeeded in perfecting an invention which will be of inestimable value to all the followers of his art, says the Times-Herald. He has experimented for years in producing a material for the use of sculptors that, while it can be made to shape in the mold, will, when removed from it, have hardened into a perfect similitude of marble.

Every sculptor has found a great drawback to his work in the fact that his best productions have been comparatively a failure from the need of a material which will reproduce them, and this is what Hans Hirsch has been fortunate enough to discover.

His invention is a material in which the plastic original can be reproduced so that the cast will show all the fine details of the artist's work, and which, while capable of being ren-

dered soft enough to take the impress of these details, will harden again and show in the finished surface a marble-like surface. Up to this time plaster of Paris has been the substance used for this purpose, but it has been much objected to by sculptors on account of its perishable qualities, being affected by contact with water and air. It also soils easily and is difficult to clean.

Terra cotta and bronze casts have been found more lasting, but because of the dark color they are not adapted for every purpose, and marble has been the sculptor's only resource. This also has its drawbacks, as many clever workers in clay are unable to work in marble, and are obliged to have the creations of their own brains copied by other hands. The expense is also very great, and not very many artists can afford to have all their work reproduced in marble.

So the value of Mr. Hirsch's invention can readily be appreciated when it is understood that it so closely resembles marble as to be undistinguishable from it in weight or the purity or clear cut effect of the work.



BOOKS AND PERIODICALS.

INSPECTOR'S POCKET BOOK, a reference book for the use of inspectors, superintendents, and others engaged in the construction of public and private works. By Austin T. Byrne, C. E. 12mo. Cloth. \$3. New York: John Wiley & Sons.

The aim of this publication is to present in as concise a form as possible (1) The duties of the inspector; (2) The characteristics and defects of the materials used in construction; (3) A description of the methods employed in preparing the materials for use; (4) The manner of placing the prepared materials in the structure; and (5) To indicate the points to which the inspector must direct his especial attention to secure a faithful compliance with the plans and specifications.

This book may not be reviewed editorially, for the reason that it is a cyclopedia of all pertaining to materials and methods of constructive work. We are not reminded of a single omission from its extensive list of subjects, that the inspector of works would naturally look for in a book defining his duties and instructions, as to their proper performance. Its directions and suggestions are not given as superseding the instructions given in specifications under which work is to be prosecuted, but it does make clear to the competent mind about everything that is called for in them.

We advise the purchase of this book by every stone man who has to do with contract work.

Contents of Appleton's Popular Science Monthly for September: "Geological Waterways Across Central America" (Illustrated), by Dr. J. W. Spencer; "Curiosities of American Coinage" (Illustrated), by A. E. Outerbridge, Jr.; "Nationalization of the Swiss Railroads," by M. Horace Mitchell; "The Evolution of Colonies—III. Immigrants and Indigenes," by James Collier; "The Nation's Crisis," by A. B. Ronne; "The Philosophy of Manual Training—IV. The Results of Manual Training," by Prof. C. Hanford Henderson; "The Case Moths (Illustrated), by Margaret T. D. Badenoch; "A Game of Hide and Seek (Illustrated), by Clarence M. Weed; "Christianized Megalithic Monuments" (Illustrated), by M. A. De Mortillet; "College Women and the New Science," by Charlotte Smith Angstman; "Sketch of Charles Goodyear" (with portrait), by Clarke Dooley.

The Chautauquan for September displays a wealth of literary matter which will find a hearty welcome in scores of homes. Subjects of general interest are treated by skillful writers, and from the initial paper on "The Literary Women of Washington," by Etta

Ramsdell Goodwin, attractively illustrated with portraits of Mrs. Burnett, Mrs. Spofford, and other literary women, to "History as It Is Made," with its concise account of the current events, the magazine is one of the best of the volume.

The American Monthly Review of Reviews for September presents the usual timely features that we have come to expect from this magazine. The various events connected with the end of the war with Spain are fully discussed by the editor, while the Porto Rican campaign, from start to finish, is described by John A. Church, formerly of the Army and Navy Journal. The cost of the war and the financial provisions for meeting it are ably summed up by Charles A. Conant, an experienced financial writer. Henry Macfarland, a Washington journalist, contributes a character sketch of William R. Day, the secretary of state, which is of special interest at this time because of Judge Day's appointment as leading member of the American peace commission. Charles Lowe, the English biographer of Bismarck, and W. T. Stead furnish a rich fund of anecdotes regarding the late ex-chancellor. Aside from many other illustrations, numerous cartoons apropos of the war are reproduced from home and foreign journals.

The complete novel in the September issue of Lippincott's is "The Touch of a Vanished Hand," by the late Miss M. G. McClelland. Its action occurs mainly in Virginia, and partly in eastern New York, during the French and Indian war of 1755.

The business founded by Frank Leslie in 1855, has recently been incorporated, and the new company has at its disposal ample capital and experience. Frank Leslie's Popular Monthly always has been steadily improving during the past three years, and despite the generally unfavorable conditions it has maintained, and at times increased its former circulation. These comparatively good results having been accomplished with the price kept at 25 cents, it is reasonable to assume that a much larger circulation and a wider field of usefulness is open to Frank Leslie's Popular Monthly as a 10-cent illustrated family magazine, and they have decided to make a change this fall both in the price and size of the magazine. The high standard of its contents will be further improved while the number of its pages will not be reduced.

MACHINERY AND SUPPLIES.

[Matter appearing under this head is compiled and edited from data furnished by the advertiser, and should not be accepted as the opinion of the publishers.]

What's a stone-worker's shop without up-to-date tools? Something like a Spanish warship going against one of Uncle Sam's modern cruisers. Get Hammacher, Schlemmer & Co's catalogue of new tools and note the "cut of 'em" in comparison with the old-fashioned articles you still have, and which it would pay you to discard instantly and buy a new equipment that would pay for itself in a short time—in efficiency and saving of strength of those who handle them. Address the company at 209 Bowery, New York City.

Before you buy the next spool of wire rope for the quarry just ask the Hazard Mfg. Co., of Wilkesbarre, Pa., to show you a sample of the rope it produces. This company has made wire rope for the quarrymen and the coal and ore miners of Pennsylvania for fifty years. It markets the whole country on even terms with any manufacturer, wherever located, having supply houses in every section. Get its catalogue.

Probably your rock drill is not just as satisfactory as you would like it to be. It is old style, but good, yet there's something lacking. Why don't you ask the Phillips Rock Drill Co., of Philadelphia, about the "Badger," a special type of the effective drill—a light, strong and durable machine, simple in construction, easily understood and not easily put out of service whatever the rock it is worked on. Write them about it. If you don't mean to buy just now, you may require a new drill before you expect, so it is well to be informed of what the latest types are.

The American Hoist and Derrick Co. is true-blue American in every sense, including its name. It has big offices and warehouses at the Four Corners of this country, and patriots in charge of each one of them. It sends steel derricks, hoists, cranes and other quarrying and contracting machinery also to every quarter of the globe, some of its more recent shipments going on orders of foreign governments for use in national improvements. Some of its patrons are potentates, but that doesn't affect its patriotism—for Old Glory flies from every gable of its works in St. Paul, and from the windows

of its offices in Chicago, Cincinnati, New York and New Orleans. "American" is a mighty good title for a manufacturing company, and infused with the loyal spirit that takes pride in making the name the synonym of all that's unconquerable, it's not surprising that this company triumphs in Russia, France, Norway, Japan and Mexico, and in the countries of South and Central America. 'Rah for the American.

Maybe you will "excurt" to Niagara Falls one of these beautiful 'ember' days. If you do take a look over the well arranged and complete shops of the Dobbie Foundry and Machine Co., in the town by the big waterfall. You will find therein most every type of machine for the use of quarrymen, and tip-top machines are those that Dobbie builds. John Dobbie is a pioneer designer and manufacturer of stone-working machinery, and has been in the business for so many years that he couldn't produce a machine that wouldn't be of the best construction if he tried to.

Pennsylvania's brownstone has a reputation for beauty and durability coextensive with the national boundaries. The Hummelstown Brownstone Co., Waltonville, is the largest producer of the finest qualities of this excellent material. This brownstone looks mighty nice in full exteriors, and brightens up and dignifies in trimming to brick structures. A half century or more of dealing in this product gives the Hummelstown concern all the prestige that need be required to warrant the integrity of its product.

Quarrymen and stone-workers would find it very convenient and serviceable to fit up a nook in the office where catalogues and descriptive pamphlets of machinery and supplies adapted to their uses could be arranged for handy reference. One of the first of these they should apply for is the catalogue of the S. Flory Mfg. Co., of Bangor, Pa., a concern that manufactures a complete line of contractors' machinery. Their specialties are slate machinery and cableway systems. Get their reading matter for your future reference.

The Lidgerwood Manufacturing Co.,

New York, a few months ago furnished a small traveling cableway for use in the construction of fortifications at Fort Pickens, Fla., the work being in charge of Major F. A. Mahan, Corps of Engineers, U. S. A. Lieut. James P. Jervey, the engineer in local charge, has been able with this cableway to handle an average for fourteen days of 880 tons per day, the maximum day's work being 1,000 tons.

The record of each day's work in skips is given below. The average weight of each skip is 2½ tons.

June 14.....	343
June 16.....	371
June 17.....	364
June 18.....	368
June 20.....	342
June 21.....	342
June 21.....	301 (two hours delay)
June 22.....	406
June 23.....	364
June 24.....	416
June 25.....	440
June 27.....	416
June 28.....	448
June 29.....	464
June 30.....	440

Fourteen days.....5,483

This record is remarkable, in that the capacity is so large considering that the size of the load is so small, and it illustrates the advantage which frequently occurs of running a light load fast instead of a large load slowly.

JOHN MASLIN & SON,

Of Jersey City, N. J., have recently issued a new list of second-hand engines and boilers, pumps and other machinery, which they desire to mail to any one looking for bargains in these lines.

TO SELL. TO BUY. TO EXCHANGE.

Advertisements inserted in this department for 15 cents per line each insertion.

MARBLE PROPERTY—Undeveloped. Fine gray and blue marble. Ideal water front and shipping point, mouth of Soo river on the great steamboat channel, 40 miles northeast of Mackinaw. Low freight. cheaply quarried. Rock bare, rising nicely from water's edge. Will give you a bargain on sale, lease or royalty. Your correspondence and investigation invited. W. B. HOUSE, De Tour, Mich.

FOR SALE—Wardwell Channeler, double cutter. Practically new. F. G. SWININGTON, Rutland, Vt.

FOR SALE—By order of Court. Complete brick making plant of W. C. Hill Estate now running at good profit, nineteen acres of land, one mile from postoffice, Seattle, Washington. Price, \$30,000. WILLIAM H. LEWIS, Administrator, P. O. Box 52, Seattle, Wash.

FOR SALE—Blue Stone Quarry, located Summit, N. Y., 37 acres; also steam drill in good condition, separate or together; price low. For particulars address T. H. MAGILL, Troy, N. Y.

HELP WANTED.

Advertisements under this heading 10 cents per line each insertion.

WANTED—To learn the whereabouts of William J. Barber, at one time in our employ as yard foreman. Address THE CULVER STONE CO., Springfield, Ill.

HELP WANTED—A good, sober and industrious marble polisher, can fine steady work at fair pay, at ECKHARDT MONUMENTAL CO., Toledo, O.

SITUATIONS WANTED.

Advertisements under this heading inserted for subscribers to STONE free of charge. Advertiser must send 25 cents to pay postage, if replies are to be addressed in care of STONE. Rate to non-subscribers, 10 cents per line each insertion.

WANTED SITUATION—Cut stone foreman desires position. Is capable of taking charge of all kinds of stone-cutting machinery. Have had 16 years' experience in cut stone business. Can give references from last employer, who has retired from business. Address FOREMAN, care of STONE.

SITUATION WANTED—By first class man as foreman or draughtsman on cut stone work. Has had large experience; can give A1 references; sober. Address P. A. J., care of STONE.

WANTED—Position; 16 years' experience as foreman and superintendent in general contract work, quarries and heavy masonry; expert on broken ashlar work. First-class references furnished. Address J. B. GORDON, Roscoe, New York.

WANTED—Situation as Superintendent or Manager quarrying and cutting stone, or either. Best references. Understand all details of the work; can read plans and handle men. CHAS. A. APPEL, Box 5 A, Middletown Conn.

ADVERTISER who is fully competent and experienced in his line, desires to arrange with good concern to represent the granite interest among dealers in Illinois, Michigan and Wisconsin on a commission basis. G. M., care STONE.

A SUPERINTENDENT OR MANAGER of monumental business. Accustomed to all classes of work, quarry, shed and office, good designer and modeler, etc. A. R., care STONE.

A STONECUTTER, 21 years old, desires a position as office assistant, draughtsman, or assistant foreman in a stoneyard. Understand plans; can lay out work, etc.; have had an education; salary no object; want experience. Address, B. E. HANSEN, 509 Pine Grove Ave., Chicago, Ill.

Locations for Industries at Chicago.

Industries located on the line of The Belt Railway Co. of Chicago are afforded unequalled switching facilities and the advantage of connecting with all Chicago railroads. They have the benefit of competitive rates and an abundant supply of cars for shipments at all times. Parties contemplating the establishment of industries in the vicinity of Chicago are invited to communicate with the undersigned, who will promptly furnish full information in regard to locations, switching rates, car supply, etc. B. Thomas, Pres. & Gen. Mgr., Dearborn Station, Chicago.

D. M. Pratt

MACHINERY, Engines, Boilers, Rock Drills, Stone Saws, Air Compressors, Steam Pumps, Pulsometers, Hoisting Engines, Cableways, etc. Send for Special Catalogue. 211 Lucas Ave., St. Louis, Mo.

NOTES FROM QUARRY AND SHOP.

An unlimited deposit of gray granite has been discovered about nine miles east of Gates, Ore., on the Corvallis & Eastern railroad. Engineers and experts have examined the rock and pronounced it superior to any yet found in Oregon, and equal, if not superior, to any from California, Washington, or the Eastern states. The deposit is very large and is located in the southwestern part of Marion county, on the west slope of the Cascade Mountains.

An ordinance precluding competition for a street paving contract by requiring the use of asphaltum which can be obtained only from premises owned and controlled by one private corporation is held, in Illinois, to be void as against public policy in creating a monopoly, although there is a provision for letting the contract to the lowest bidder.

Negligence of a foreman in a quarry in failing to give timely warning of a blast, whereby one of the workmen is injured, is held, in Bellville Stone Co. vs. Mooney (N. J.) 39 L. R. A. 834, to be in respect to the duty of the employer and imputable to him, and not one of the obvious dangers of which the risk was assumed by the employee.

A remarkable cart was lately observed by an African traveler. The cart was drawn by ten oxen, and the wheels were constructed of massive stone, each weighing about half a ton, and as the cumbersome vehicle rolls along the great wheels emit piercing screeches, which can be heard half a mile away, and yet it is no uncommon sight to see one of these ten-ox carts with no greater load than some hay.

The half dozen stone quarries in Le Roy, N. Y., are all doing a large business and are working large forces of men. The Le Roy stone crushing machinery is now being placed, and the immense plant on the Lehigh railroad northeast of the village is also nearing completion. When these are in operation Le Roy's stone business will be one of its leading industries, furnishing employment for hundreds of men and sending her famous blue limestone to all parts of the country.

Black River Falls, Wis.—Efforts are being made by a prominent citizen to organize a party to go in search of a marble quarry, lo-

cated near the two Traverse bays, in the lower peninsula of Michigan. The quarry came to the notice of Jim Preston through an old Indian in the year 1849, and the marble there was pronounced to be of excellent quality. Preston has been dead for several years, but left minute description of the location, which at that time was in a dense forest of hemlocks.

A strolling stone-cutter did a good stroke of business in Plainfield, N. J., a few days ago. He cut the names of merchants deep in the pavement in front of their stores, and painted the letters crimson. These signs were unsightly and, of course, would be useless in case the advertiser moved, unless he took away a part of the sidewalk.

Everything is in readiness to soon begin work on the big breakwater at San Pedro, Cal. Messrs. Heldemair & Neu, of Chicago, to whom the contract for performing the work at a cost of \$1,349,000 was recently awarded by the secretary of war, have put up a bond of \$300,000, which has been approved. Fully 2,290,648 tons of stone will be used in the work. The breakwater is to be 9,500 feet long. Its width will vary according to the depth of the water.

In the month of August there were shipped over the Monon from the Bedford, Ind., stone quarries 2,109 carloads of stone, mostly to Eastern states, against 1,052 in August, 1897.

Paris is capricious even in the matter of her public statues, which are being constantly dethroned and others set up in their places. The deposed ones are stowed away and there are yards at Auteuil full of them. As for the streets their names, of course, change with every change of the wind.

Sandstone, Minn.—The sandstone quarry at this place is now employing over two hundred men, and were it possible to increase the number of men it would be done, but common laborers cannot be secured at even \$1.50 a day. Orders are now booked that will keep the present force busy till snow flies.

The brownstone industry is now being pushed somewhat. A report says that this year \$20,000 worth of stone has been shipped from the Aldrich quarry at Sanford, N. C.

*Mr. Thomas A. Edison
examines a "New In-
gersoll" Rock Drill.*

*An order for 8 additional Drills
is the result. Making 15 in all,
for his Works at Edison, N. J.*



THE "NEW INGERSOLL"

(WRITE FOR CIRCULAR.)

Air Compressors—Rock Drills—Coal Cutters

The Pohle Air Lift Pump.

The Ingersoll-Sergeant Drill Co.,

HAVEMEYER BUILDING, N. Y.

Kennett Square, Pa.—The stone for the walls of the new fiber factory in this borough is being furnished by the Avondale Marble Company, and a few weeks ago Sheriff Ingram levied an attachment upon the purchase money for a claim which the Kennett Square Electric held against the stone company. The matter at issue will be determined by the August court.

Chicago, Ill.—The Wisconsin Lime and Stone Company, 386 N. Kedzie avenue, made an assignment in the County court. John C. Williams is its assignee. The assets of the company are estimated at \$60,000, while the known liabilities amount to nearly \$25,000. The trade of the insolvent firm is said to have declined in volume of late, and this circumstance, together with a confessed judgment of \$3,975 entered in favor of William and August Nast, lime dealers at Marblehead, Wis., occasioned the failure.

Francis Morris Pirsson, sixty years old, New York agent of Indiana limestone quarries, died August 4, after a brief illness. He was born in New York City. For the last ten years had been with the limestone quarries.

John Mullen, of Bridgewater, Pa., and owner and operator of the Bridgewater quarries, died after a short illness on August 2.

The Hughes Granite and Marble Company, of Clyde, O., has been incorporated with a capital stock of \$50,000, and J. C. Royer, John M. Sherman, Homer Metzger, F. G. Jacobs, H. E. Rhoads and W. E. Hughes are the incorporators. The company will develop marble quarries in Georgia which are very extensive and valuable.

South Bend (Ind.) Portland Cement Company have been filed with the secretary of state. The capital stock is \$10,000; object, the manufacture and sale of Portland cement; directors, John Lux, Charles H. Atkinson, Aman Moore and Lee W. Atkinson.

Cloverport, Ky.—Proctor Keith is reported as to combine with Clarence Keith, of Leitchfield, Ky., and to enlarge the work at Cloverport and install pneumatic machinery for working marble.

Mr. and Mrs. Ed Wilson, partners in Mrs. Churchman's stone quarry at Cockle Burr, Iowa, broke their own record one day recently and loaded seventeen wagons with rock. There seems to be new fields opening for women, says the local paper.

Davenport, Iowa, Sept. 2.—The 17-year-old daughter of Peter Boyle, a prosperous farmer, fell from a boat yesterday afternoon and was drowned before the eyes of her girl friends. They were rowing in an infuriated (?) stone

quarry and the water was about twenty feet deep. Her body was recovered in the evening.

A large amount of building stone is being shipped out from the Dell Rapids, S. D., quarries. The demand is better than it has been for some time.

The marble business in Rutland, Vt., and vicinity is constantly on the gain. The Vermont Marble Company and True Blue Marble Company report a steadily increasing business over a year ago, both in interior and monumental work.

The Machine Stone Workers' union, of Greater New York, elected Michael O'Hara its business agent, and is fast recuperating from the result of its recent strike against a reduction in wages.

The New York branch of the Granite Cutters' union has placed in nomination as delegates of the national union to the annual convention of the American Federation of Labor in Kansas City next December, William J. O'Brien, of New York City, and James Duncan, of Baltimore.

The Marble Cutters' union, of Chicago, has decided to heavily fine members who take sub-contracts, as that is against the laws of the organization. The rule was made to protect contractors.

The Boston stone is found on going out of Hanover street into Marshall street. It is a round stone imbedded in the wall, and this curious old landmark was originally a paint mill imported from England, and afterwards was famous as a starting point for surveyors.

Marquette, Mich.—The Portage Entry Quarries Company is enjoying a good year's business in the matter of local trade. The amount of red stone used in the construction of buildings in Houghton county will nearly, if not fully, equal the total amount previously used in its history. The demand for red stone has been improving of late from outside territory, and the season's business will prove highly satisfactory.

Belleville, Ill.—Mr. Bart Kissel, the marble dealer, recovered a judgment for \$50 against Mrs. Eva Beck, that being the balance she owed on a \$500 monument erected at the grave of her husband, the late Jacob Beck. After hearing the evidence for the plaintiff, Judge Guentz adjourned his court to Mrs. Beck's residence, and there heard her testimony. It didn't help her side of the case, for Mr. Kissel got judgment for the amount he claimed.

A large stone quarry has been opened near Omer, Mich.

Sullivan Quarry Bars Sullivan Gadders Sullivan Rock Drills.

RAPID. STRONG. CONVENIENT.



THE SULLIVAN QUARRY BAR.

Channeling Machines for All Kinds of Work.

Contractors for

Prospecting Quarry Lands with Core Drills.

SULLIVAN MACHINERY CO.

Main Office, 54 to 60 N. Clinton St., CHICAGO. Eastern Office & Works, CLAREMONT, N. H.
339 Fifth Ave., PITTSBURGH, PA. 412 Seventeenth St., DENVER, COL.

Please mention STONE when you write to advertisers

x

Options have been secured by eastern capitalists on three farms southwest of Arlington, O. It is understood that a large cement manufacturing establishment is to be established on the land in the near future. It is understood that one or more of the options expire on September 1. The land is underlaid with stone and is valued at about \$90,000 in the aggregate or from \$250 to \$300 an acre. This project is headed by Professor Roberts, a prominent citizen of Dayton.

Danville, Ill.—Kirk Sultzbarger, of Springfield, has taken a partnership in the Vermillion Shale Brick Co. with E. W. Crumlich. The plant when completed, will be one of the largest and most complete in this part of the country. It will employ about twenty-five men. The firm will soon commence the erection of a big drying room, about eighty feet square and also eight or ten large kilns.

The people of Franklin, Me., are looking for a boom in business following the opening of the Washington County railroad. The road will run through a granite section which has not been developed because of absence of shipping facilities. Already owners of these granite fields are looking over the ground with a view of opening quarries. The road runs near a field of splendid red granite which was too far removed from water to make its shipment by vessel practicable. It is understood that a company is being formed to open a quarry.

Greencastle, Ind.—Meltzer & McIntosh have purchased the Allen monument works. The two plants will be consolidated.

Utica, N. Y.—The Utica Stone Company has been dissolved by mutual consent. Frank P. Baker retires from the business which will be continued by Reusswig & Co.

Waterloo, N. Y.—Edson Brothers have leased the Emmett quarry to supply stone to the New York Central railroad. The limestone rocks are being blasted out with dynamite.

Joliet, Ill.—The Federation of Labor which was appealed to by the striking stone quarrymen to boycott the stone of the Joliet quarries where the owners refused to accede to the strikers' demands, has decided to keep its hands off the fight.

Benjamin Lewis, Ellis Prichard, John B. Williams and Robert Thomas, of Fair Haven, Vt., are opening a slate quarry near the Evergreen slate quarry, which promises to be one of the best in that section.

Brandenburg, Ky.—The American Lithographic Stone Company organized at this place August 1, was incorporated for the purpose of working a quarry of lithographic

stone which is located on the farm of Alonzo Moremen a short distance above this place. The stone has been thoroughly tested and is said to be as fine as any lithographic stone ever found.

New York.—Judge McLean, of the Supreme Court, has appointed Armitage Matthews receiver of the assets of Plock, Steineback & Murray, marble and stone workers, at 541 W. Twenty-second street, in proceedings for a dissolution of the partnership brought by Ferdinand Steineback against Charles Plock and John L. Murray. They had been in business five years. The partnership was dissolved on June 23 last, but the partners could not agree as to the liquidation of the business. The assets were \$7,000.

Duluth, Minn.—Proceedings have been brought against the Iron River Red Sandstone Company by James R. Severance to recover \$6,000, claimed to be due on a promissory note given March 20, 1894, and secured by mortgage on the company's plant.

The plant of the Maine and New Brunswick granite company at Calais, Me., was sold at auction and purchased by C. W. Young, of St. Stephens, the president of the company, for \$20,000. It is generally supposed now that Mr. Young has secured the ownership of the plant that he will start up the works, which has been closed some time.

Avondale, Pa.—As a consequence of the recent election at the Avondale Marble Company, suit has been brought against the company for return of stock alleged to have been illegally voted, one of the defendants being R. Hope Hepburn. The case will have an airing in the Chester County Court on August 15, when a better knowledge of the difficulty will be obtained by the public. Mr. Hepburn and others think they are imposed upon, and intend to see "where they are at," appealing to law to give them justice.—West Grove Independent.

Hamilton, O.—Joseph B. Hughes has brought suit against C. L. and J. B. Cornell, as administrators of the estate of the late G. B. Cornell, claiming \$19,500. Plaintiff alleges that he and George Hughes purchased the Piedmont Marble Works, in Georgia, for \$10,000, and that J. B. Cornell, as trustee, was authorized to sell, and the proceeds to be equally divided. Plaintiff alleges that Mr. Cornell did sell the marble works in 1893 for \$40,000, leaving a margin of \$30,000, and it is for the half of this, with accrued interest, that the suit is brought.

Lebanon, Pa.—J. B. Millard, of this city, recently bought the Ulrich farm, situated at West Annville, and started a force of men at work in the quarry on the farm. The quarry will be worked quite extensively and large shipments of fluxing stone and lime will be made.

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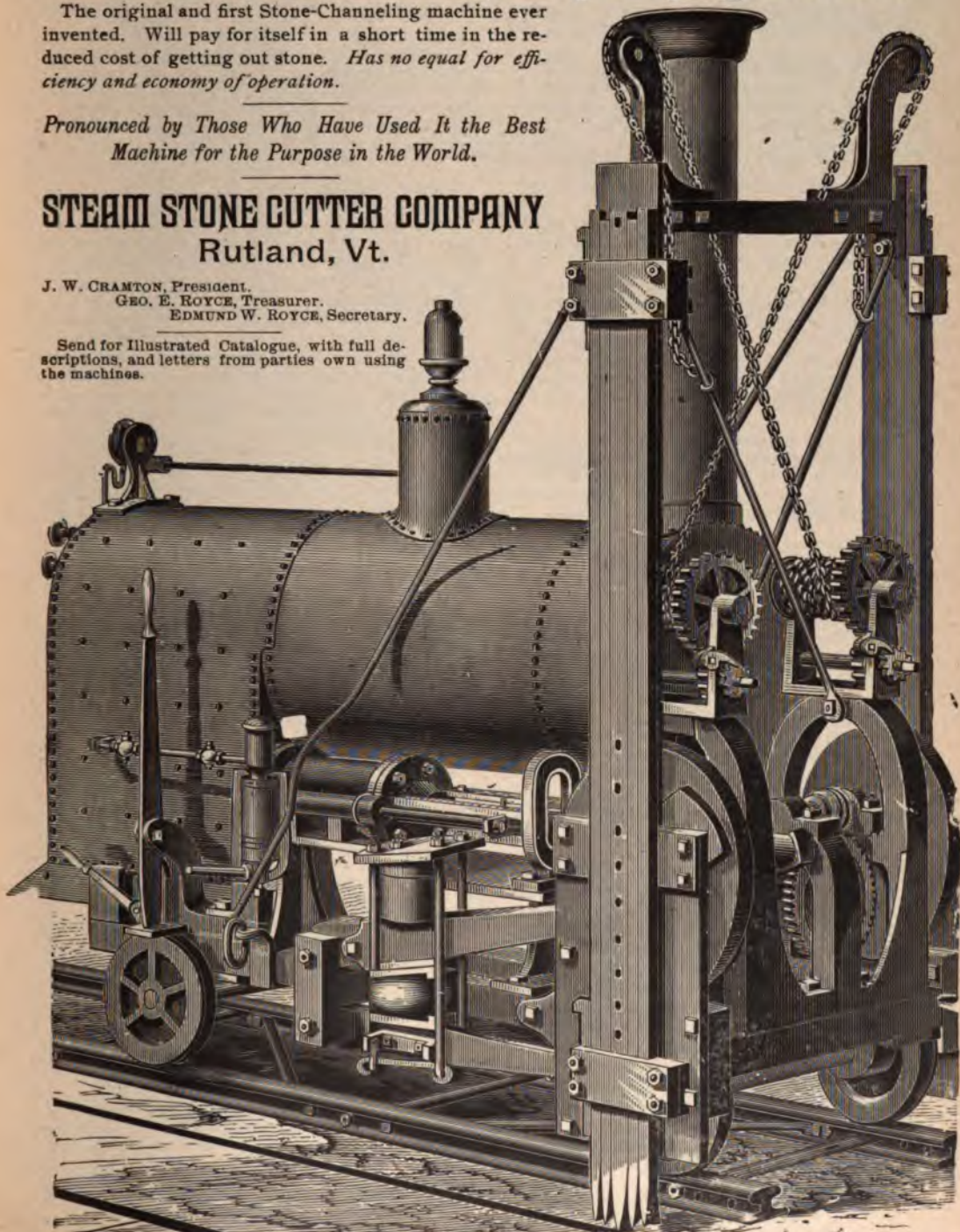
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Mankato, Minn.—The Mankato Lime and Stone Company's quarry and property was sold at mortgage sale recently to satisfy the first mortgage amounting to \$3,400, and held by Robert O. Craig, of Janesville. Some months ago their property was sold under a second mortgage held by a party living in the east.

Toledo, O.—Motion has been filed in common pleas court asking for the appointment of the sheriff as receiver of the New Process Lime Company, and that he may sell the plant, the proceeds to apply toward the payment of George C. Cone's judgment.

Danbury, Conn.—William R. Miles, wholesale dealer in granite and building materials, assigned to Levi K. Mansfield.

Alex K. Boyer has purchased the interest of Mr. Phil Weiskopf in the firm of Boyer & Weiskopf, proprietors of the Carmi (Ill.) Marble Works, and the partnership heretofore existing has been dissolved by mutual consent. Mr. Boyer will continue the business.

The firm of Jordan & Hayes, stone contractors has been dissolved by mutual consent. The business will be continued by Mr. D. P. Hayes, who will collect all money due and pay all debts against the firm.

J. C. Peniwell has sold out his monument works in Wichita, Kan.

The Napoleon, O., monument shop has again changed hands, Messrs. Halter & Musser becoming proprietors. The change was made August 2.

Paducah, Ky.—Messrs. F. J. Scholz & Co., of Evansville, Ind., are to have a branch monument works here. They have bought out W. D. Downs & Co., and will assume charge of it in about sixty days. They are agents for the Green River stone, and will enlarge the works when they take charge.

Massillon, O.—Earl W. Busby has purchased the interest of Edward L. Hering in the livery and monument business, heretofore conducted under the name of Stansbury & Hering. The firm is now Stanbury & Busby.

M. J. Woodworth has formed a partnership with Norman R. Stedman in the marble and monument business at Warsaw, N. Y., the firm's name being Stedman & Woodworth.

Through a similiarity of names, and the fact that the head offices of the Marblehead (Wis.) Lime Company and those of the Wisconsin Lime and Stone Company were located in Chicago, the name of the Marblehead Company became confounded with that of the Wisconsin

concern, and some papers the failure of the Wisconsin company was charged up to the Marblehead concern. The company which made the assignment was the Wisconsin Lime and Stone Company, and its plant is located at Germantown, Wis.

Halderman Bros., of Cleveland, O., have purchased ground on the William Groves farm near Tippecanoe, Harrison county, on which they will open a pulp and grindstone quarry. A grindstone lathe and mill will be erected and side track put in.

A new branch of the stone industry in Lemont, Ill., seems well under way and work has already been commenced. The scene of operations is one of the Brown quarries situated about a quarter of a mile below the Alton depot. It is expected that the work will not assume very large proportions this fall, although if there should be a heavy demand for stone a big hustle will be made to fill any and all orders. S. B. Brier is understood to be one of the company, and is superintending the work. J. G. Bodenschatz and other Lemont men are also understood to be interested in the venture.

Northfield, Vt.—Prof. Charles Dole and C. C. Brill were in Castleton, Brandon, Poultney and other places in Vermont, investigating the methods used in quarrying slate. If they find it feasible they will upon their return immediately open the quarry recently purchased of William Holden.

Columbia City, Ind.—S. P. Paulus has established a monument works.

J. W. Davis is now sole owner of the Parkman, O., monument works, having bought out his partner, A. N. Burgess.

Morrice, Mich.—Prospects for a cement factory here are good. W. J. Richardson, prospector, has found abundance of material of marl and clay to produce an excellent article. A stock company will be formed by F. E. Purdy, A. L. Beard, B. F. Rann, Sam Crouch and W. J. Richardson. The factory will employ fifty men.

Frankfort, Ind.—Cann, Harshman Monument Co. is a new business firm here. It is composed of Howard Cann and Howard Harshman.

Sparta, Ill.—C. B. Skelly, has opened a marble and granite shop.

Quincy, Mass.—The long-established granite firm of Milne & Chalmers has been dissolved, and Andrew Milne will continue the business. George Chalmers, the junior member, will return with his family to Scotland.



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H. D. Phillips & Co. are soon to remove their granite business from Northfield, Vt., to East Barre, where they have special inducements offered them to locate.

Joliet, Ill.—The stone quarry strike that took place here June 1 has been settled by arbitration, and the men will go to work at the old price—\$1.50 for ten hours' work. No men but members of the Quarrymen's National Union are to be employed. The settlement was made August 9 by a committee of the Trades and Labor Council, quarry owners and officers of the quarrymen's union. The present scale is to last until the new year. The stone business in Joliet has been practically at a standstill for two months.

Kansas City, Mo.—While handling a block of stone in the yards of the Phoenix Cut Stone Company, March 8 last, the tackle broke, and James Louttit was caught beneath the falling mass and sustained severe injuries. He has filed a suit against the company for \$10,000 damages, claiming in his petition that he was crippled for life, and that the negligence of the company was responsible for it.

Commissioners appointed to appraise the stone quarry property of J. A. Wilson, at Wilson, Wis., for railway right of way have placed the damage at about \$4,000.

Syracuse, N. Y.—The firm of Hurlbert & Sholton has purchased the property known as the wagon factory of J. H. Abbott, and is doing a wholesale business in monumental work, mostly from Gouverneur marble. The firm already employs about a dozen men, and intend to increase its force of stone-cutters as soon as the works are fully equipped.

Rock Island, Ill.—The annual convention of the International Stone Cutters' Union was to have assembled here August 3, but owing to a failure, it is understood, of the local branches throughout the Union to select delegates, it was not held.

A vein of slate has been found in the east part of the town of Poultney, Vt. This is the first time slate has been found in that section, the other slate interests being in the northern and southern parts.

A stockholder of the Brainerd Shale & Hall Quarry Company in speaking of the strike at that quarry in Portland, Conn., said that no more work will be done by the company this season in any event. The season is now so far advanced that but little stone could be got out, and according to the local stockholder they have decided to suspend operations until next season, whether the men yield or not.

Frankfort, Ind.—The firm of D. W. Paul & Co., monument dealers, has been dissolved, H. A. Cann retiring. Mr. Paul will continue in business at the old stand.

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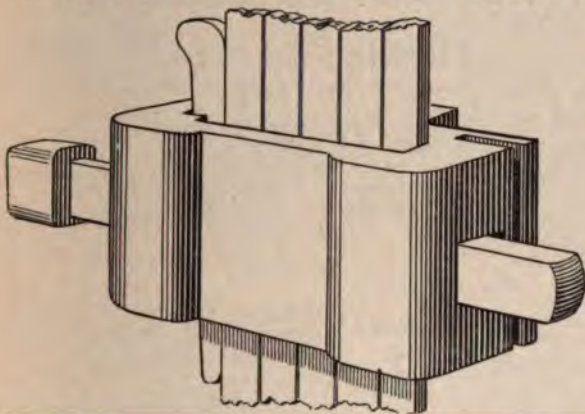


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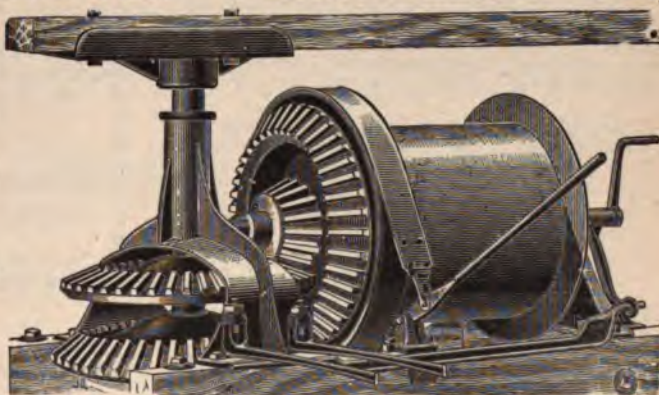
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xiv



Marshalltown, Iowa.—The Marshalltown Stone Company. The capital stock of the concern is \$25,000 and Mayor F. G. Pierce is president and Charles H. E. Boardman secretary and treasurer. Several weeks ago Messrs. Pierce and Boardman purchased the stone quarry near Rockton, and they propose to operate it.

Staten Bung died in St. Paul, Minn., at the age of 76. Was for many years actively engaged in contracting for stone and brick mason work.

Jordan & Hayes, stone contractors at Mankato, Minn., have dissolved partnership. The business will be continued by D. P. Hayes.

Appleton, Wis.—Frank Freis has sold his half interest in the firm known as the Appleton Marble and Granite Works to Henry Hegner.

Taylorville, Ky.—Dan O'Leary has sold out his interest in the monumental works to Mr. Frank Lucke.

La Crosse, Wis.—Leffingwell & Wilcox have purchased the stock of the defunct monument firm of Symonds & Hunt.

Basil Richardson, of Cumberland county, has sold his interest in the Pilot Knob, Ky., lithograph quarry for \$1,100.

LaFayette, Ind.—J. George Kessler has purchased the interest of A. M. Baum, the senior member of the firm of Baum & Vitts, monument dealers. The firm name will be Vitts & Co.

Massillon, O.—A strike is on among the stone-cutters at the State Hospital grounds. R. J. Evans & Co., the new contractors, offer but 35 cents an hour to the men. The union rate is 40 cents. Of the thirty men at work, twenty-three quit. The men now working are all non-union men from Cincinnati.

Coldwater, Mich.—A short time ago the Michigan Portland Cement Company, a corporation capitalized with \$2,500,000, secured options on the controlling interest in the Coldwater Portland Cement Company, and August 25 Mr. Geo. N. Beaton, of Detroit, representing the Michigan Company, has closed the deals with local holders of stock in this company. The Coldwater Portland Cement Company will therefore no doubt soon be merged into the larger organization, and the Coldwater plant greatly benefited by the increased capital behind it. The transfer will in no way change the present local officers. The cement works are being erected as rapidly as possible.

Clyde, O.—The newly incorporated Hughes Granite Marble Company organized by electing W. E. Hughes, president; H. E. Rhoads, vice president; F. G. Jacobs, secretary; Homer Metzgar, treasurer. The directors are: F. G. Jacobs, Homer Metzgar, H. E. Rhoads, C. A. Shinning and C. Schlenk.

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Siegfried, Pa.—The Lawrence Cement Co. expect to erect a number of fireproof mill buildings and stock houses at this place for a new plant, to have a daily capacity of 2,000 barrels of Portland and common cement. Plans are now being prepared by Lathbury & Spackman, 1619 Filbert street, Philadelphia.

G. and F. Prucia will open a new marble shop at Darlington, Wis., the 1st of September.

Philadelphia, P.—The old Trumbauer property, on Powdermill lane, has been sold to Clark & Co. for \$7,500. The purchasers will grade off this ground and use the material taken off for filling in the old quarry hole. It is expected that good stone will be found under the dirt, and this will be quarried for building purposes.

The Santa Fe R. R. will operate large stone quarries near Eskridge, Kan.

Cloquet, Minn.—Levi Dietz has made arrangements with a Mr. Miller, of Chokio, Minn., to come to Cloquet and lease the slate quarry and begin work in November. The slate quarry has been idle for years.

M'Minnville, Tenn.—A new marble and granite firm is composed of Messrs. S. Freeman and E. J. Argo, who have been engaged in the same business at Valdosta, Ga.

Portland, Conn.—The strike of the Brainerd, Shaler & Hall quarry company was settled by the 150 strikers accepting the offer of the company of 16½ cents an hour. The men demanded 19 cents an hour and have been out on strike for about two months.

Stoutsville, O.—J. U. Baker and Jim Collins and Jim Baker are opening up a stone quarry on the Pickaway Co. Infirmary farm.

Owosso, Mich.—Among the business acquisitions which are sure to be added to Owosso's list of enterprises will be a large cement plant. Geo. D. Abrey will be the prime mover in the business. He has discovered that much of his land in the eastern part of the city is underlaid with a deep bed of the purest cement. He will organize a stock company, Detroit parties already being interested.

Albion, Ill.—Mr. D. W. Graham has opened a marble and granite shop.

Thomas Beaulac will open a marble shop in Burlington, Vt.

Newport, Ind.—The sheriff sales against the Hanging Rock Sandstone Company were all disposed of recently.

The case of the Knox Rock Blasting Company vs. the Grafton Stone Company, Grafton, O., was filed in the Supreme Court from the courts of Lorain county. Fifteen hundred dollars is claimed under a contract for using patented machinery.



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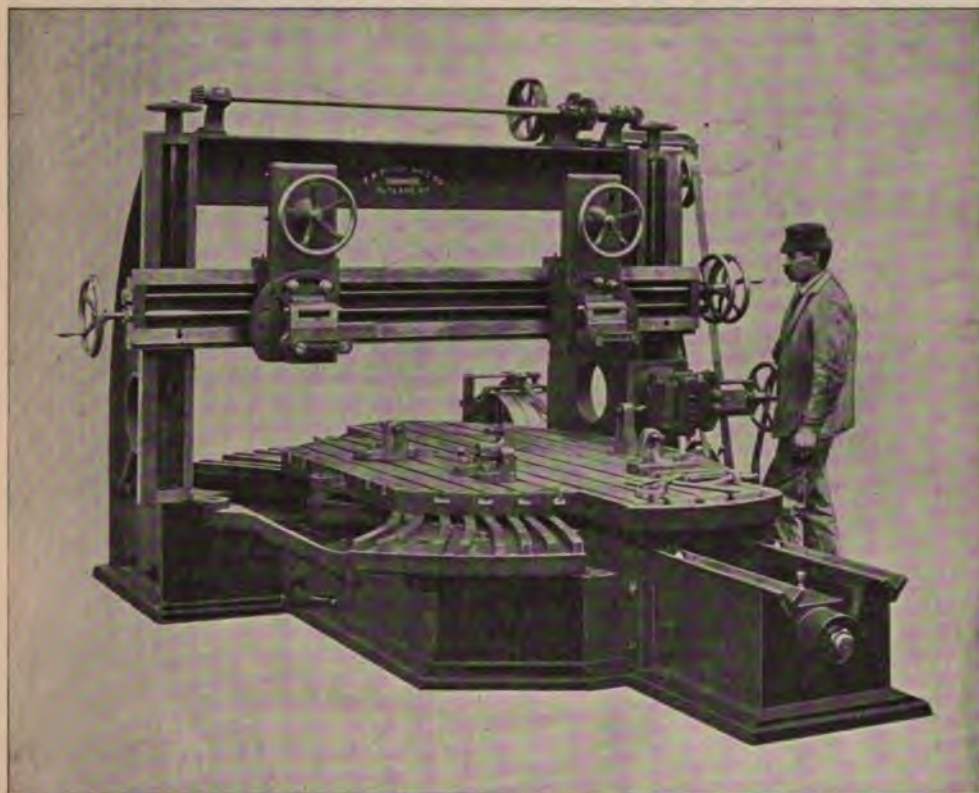
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xviii

Fostoria, O.—The Fostoria Stone and Lime Company assigned to William Jaeger August 25. The property is bonded for \$15,000 and has \$3,000 additional indebtedness. Assets are considerably less. The assignment was precipitated by the sudden departure recently of Fred Lytle, who managed the plant under a contract, but used the company's credit, and is said to have "stuck" them for at least a thousand dollars.

The slate on the bank and other personal property at the Midvale quarry, at Wind Gap, Pa., operated by George Bates, was sold at constable's sale on several attachments issued for wages due the employees.

Papers have been filed in a suit for \$10,000 damages against the Fort Madison and Appanoose Stone Company, Ft. Madison, Iowa, and in favor of Chas. Siegfried, who last June had one of his feet so badly injured while in their employ that partial amputation was necessary.

Youngstown, O.—Albert A. Limber has brought suit against William Riblet for \$1,000 damages, the result of an alleged violation of contract. Limber claims that he leased a stone quarry and certain machinery connected with it, but that previous to the expiration of the lease the defendant removed the machinery and refused to allow him to proceed with the operations of the quarry, to his great damage.

New Albany, Ind.—The Blue Rock Cement Company, with a capital stock of \$75,000, and comprised of New Albany and Jeffersonville capitalists, has been organized.

Louisville, Ky.—Articles of incorporation of a new cement mill have been filed. The names of the incorporators were not given out, but Pittsburgh capitalists are supposed to be interested in the new company. The capital stock is fixed at \$35,000. The mill will be known as "The Hoosier." The mill will be located on the Schlebrede farm, about five miles north of Jeffersonville, Ind. This will make the seventeenth cement mill operating in this district.

The National Stone Company, of Cleveland, O., was incorporated recently; capital stock, \$25,000. The incorporators are: Fred Axel, Emil Bierfreund, M. P. Platten, H. E. Adams and Gustav A. Laubscher.

The New Brunswick Marble Company, at Pierre, S. D., with a capital of \$150,000. Incorporators: E. L. Squire, Jerry Maronne, New York; Phil Smith, Sioux Falls.

Albany, N. Y.—The certificate of consolidation of the Helderberg Cement Company and the Howe's Cave Lime and Cement Company has been filed with the secretary of state. The new company, which is controlled by local capitalists, is named The Helderberg Cement Company. The capital stock of the corporation is \$300,000, divided into 3,000 shares of common

stock, the par value of \$100 each. The corporation will operate at Howe's Cave, Schoharie county. The company is organized to manufacture lime, cement and plaster, and to mine and dress stone. The manner of distributing the capital stock of the company among the shareholders of the companies consolidated is as follows: "The capital stock of each of the corporations shall be converted into the capital stock of the new corporation, share for share, and upon surrender of outstanding certificates of stock in either of the first-named corporations, certificates for like amounts of stock in the new corporation shall be issued to the holders thereof." The directors of the company are as follows: T. Henry Dumary, John W. McNamara, Albany; Chas. E. Lee, Binghamton; C. H. Ramsay, of Howe's Cave, and John J. Cassin, of Rensselaer.




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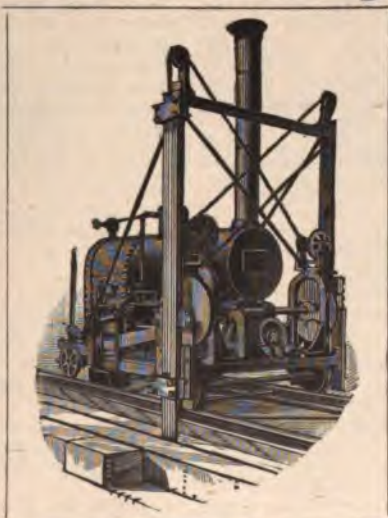
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CONTRACT NEWS.

Port Clinton, O.—Architects Wing & Mahurin, Fort Wayne, Ind., are preparing plans for a court house for Ottawa County to cost \$120,000. Building to be as near as possible a duplicate of a new court house at Knox, Ind., built by the same architects.

Kansas City, Mo.—The Pasco fountain was approved, and will cost \$7,500. Bids will be advertised for at once. M. Kessler, Secretary of Park Board.

Bridgeport, Conn.—The City of Bridgeport, Conn., invites architects to submit competitive designs for the erection of a new City Hall building. Particulars may be had September 1, by addressing C. L. Banks, Chairman.

Bay City, Mich.—G. W. Ames is organizing a company to build a new \$150,000 office block in Bay City.

Champaign, Ill.—The city will co-operate with the Illinois Central for the construction of a \$25,000 depot to replace the one recently destroyed by fire.

Chicago, Ill.—Plans are being prepared for a Union Passenger depot which will be used by eleven railway companies.

Woodville, Pa.—The bids for the new insane asylum have been rejected. New bids will be advertised for at once. Cost not to exceed \$250,000.

Freeport, Ill.—The Freeport city council passed an ordinance providing for a new city hall which is to cost not over \$30,000.

St. Louis, Mo.—A new Catholic Church is to be built. It will cost \$125,000. Rev. J. J. McCabe, Pastor.

Grand Rapids, Mich.—General Manager Hughhart, of the G. R. & I. Ry. is receiving plans for a new Union Depot, to be built of brick and stone, and 400 feet in length.

Fortress Monroe, Va.—Bids are asked until September 16 for furnishing cement, broken stone yellow pine lumber, steel beams, etc. Capt. Thos. L. Casey, U. S. Engr., 166 Cranby St., Norfolk, Va.

Boston, Mass.—Bids are asked until September 17 for purchasing 10,000 American white marble headstones in slabs. J. McE. Hyde, Q.-M., 195 Summer St., Boston.

Kalamazoo, Mich.—Library, Kalamazoo College, owners, Patton, Fisher & Miller, Chicago, architects. Contracts not let. Cost \$25,000. Brick and stone, stone trimming, cement floor.

Nebraska City, Neb.—The question of a new jail for Otoe County is being agitated, the estimated cost to be \$10,000. The old jail is damp and unhealthy.

Charlotte, Tenn.—Plans have been prepared for the proposed court house and jail to be erected in Dickson county. Estimated cost \$15,000.

Columbia, S. C.—Plans have been prepared by W. B. Smith Whaley & Co. for an \$18,000 Y. M. C. A. building. F. H. Hyatt, President.

Chalmers, Ind.—The Baptist Society has accepted plans prepared by Niemann & Gault, LaFayette, for the proposed \$7,000 church.

Jacksonville, Ill.—The Presbyterian Society has engaged Chas. Cropsey, Cincinnati, to prepare plans for a new church.

Oxford, O.—The President and Trustees of the Miami University will receive bids for new east wing to main building, for extension of west wing to main building, and for certain improvements in the north dormitory, and for a steam heating apparatus, September 13, 1898. Said bids will be taken for the whole or any part of the work for the following: Excavation, stone masonry, cut stone work, cement paving. W. O. Thompson.

Henderson, Ky.—Surveys are being made by the railroads entering Henderson for the construction of a union passenger station and freight depot. The roads entering Henderson are the L. & N., H. & St. L. and I. C.

Paris, Ky.—The city authorities of Paris have purchased a lot and will erect a city hall. The business of the city requires several offices, a calaboose and fire department, and the city will build a handsome house.

Elgin, Ill.—The Asylum trustees contemplate the erection of a store house, morgue and infirmary to cost \$75,000.

Dupuyer, Mont.—Father Prando is raising money for the erection of a new Catholic church here. It will be built of stone.



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Please mention STONE when you write to advertiser

xxii

Cincinnati, O.—Church. First Universalist Society, owners. Hannaford & Sons, Cincinnati, architects. Contracts not let. Sandstone, stone trimmings, mosaic work, slate roofs.

Port Clinton, O.—Plans for the new court house have been accepted, and bids will be advertised for shortly. The building proper will cost \$50,000, and be built entirely of stone with Berea stone facing. It will be three stories high. Wing & Mahurin, Ft. Wayne, architects.

Kansas City, Mo.—Press reports state that the Rock Island Railroad Company has in contemplation the erection of an immense freight depot and cold storage plant at Twelfth and Wyoming streets.

Whitefish Bay, Milwaukee, Wis.—Pabst Brewing Company, Milwaukee, Wis., owners; Clinton J. Warren, Chicago, architect. Summer hotel. Making sketches; contracts not ready to let. Cost \$1,000,000; two stories; brick, stone, cement work, marble work, sidewalks and pier.

Grove Hill, Ala.—The Clark county court has decided to build a \$15,000 court house.

Marietta, Ga.—Bids will be received Sept. 29 for building a \$40,000 court house for Cobb county. Golucke & Stewart, Atlanta, Ga. Three-story, 60x80; brick, marble.

Ithaca, N. Y.—The plans have been completed for the erection of a \$45,000 chemical laboratory for Cornell University. The building is to be completed by June, 1899.

Sioux City, Iowa.—The Floyd Memorial Association, composed of old settlers and business men of Woodbury county, Iowa, and a number of well known men in different parts of the United States, propose to secure legislation for the erection of a handsome monument at the site of the grave of Sergeant Charles Floyd. It is the idea of the Association to secure about \$6,000 for this monument.

Akron, O.—Grace M. E. Society, owners. Chas. Henry & Son, architects. Bids will be received September 10. Cost \$16,000. 72x90. Two story. Brick, stone, cement work, slate roofs.

Painesville, O.—A \$12,000 library building is to be erected in Painesville this fall as the gift of J. H. Moreley, of Cleveland, and will be known as the Moreley Library Building.

Columbus, O.—The State Building Commission will receive bids for the construction of the new State Building at Columbus, O., September 24, 1898. The following are some of the branches of work to bid upon: Cement work, marble work, tile and mosaic work, stone masonry, cut stone work. For particulars address S. Hannaford & Sons, architects, Cincinnati.

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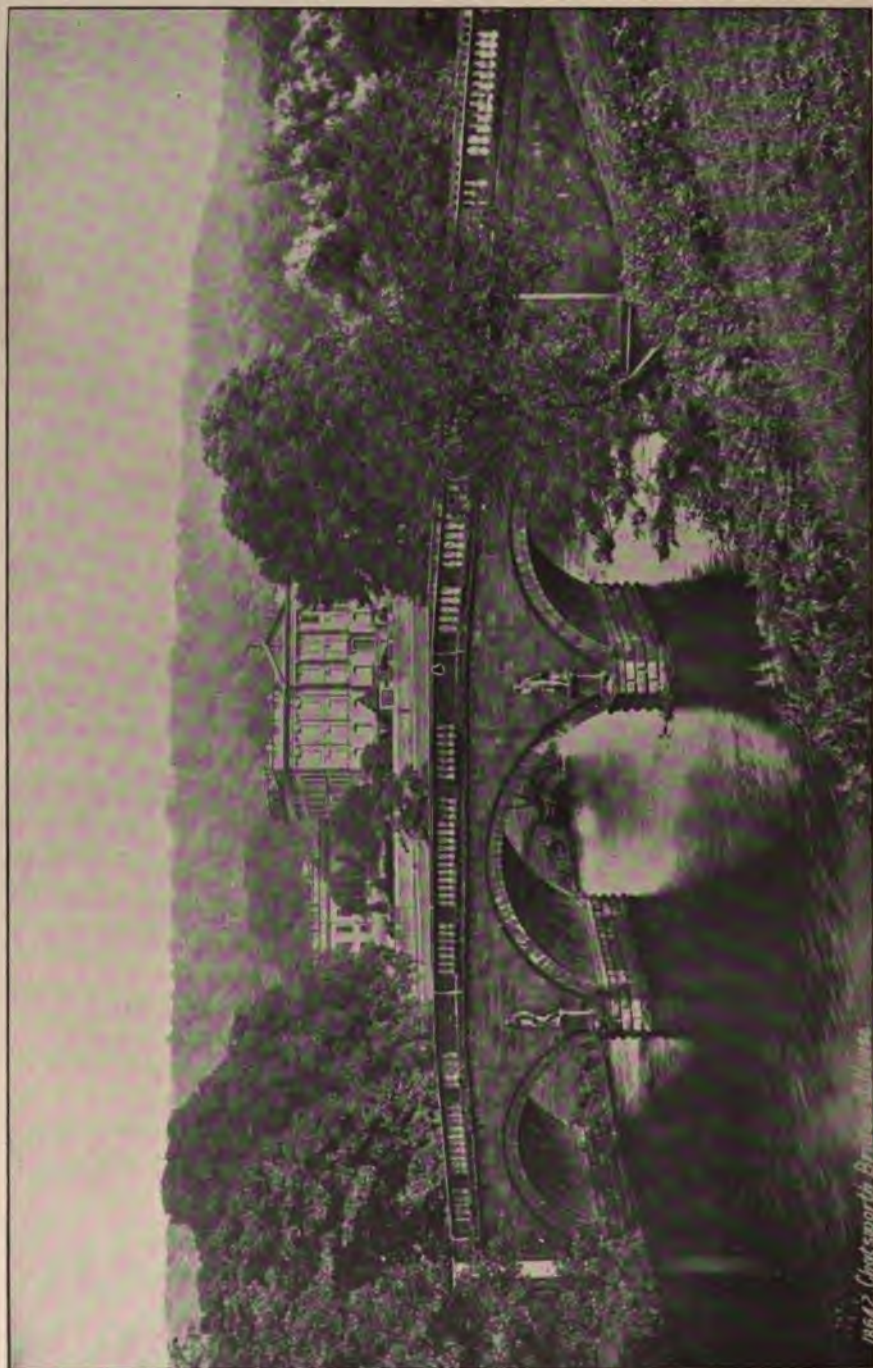
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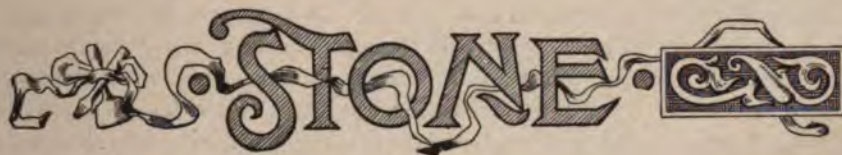
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THE CHATSWORTH BRIDGE AND HOUSE, ENGLAND.



VOLUME XVII.

OCTOBER, 1898.

NUMBER 5.

MACHINE VS. HAND-CUT STONE.

IN DEFENSE OF THE MACHINE.

"And the house when it was building, was built of stone made ready before it was brought thither; so that there was neither hammer nor axe, nor any tool of iron heard in the house when it was in building."—I. Kings, 6th chapter, 6th verse.

"All these were of costly stones, according to the measure of hewed stones, sawed with saws within and without even from the foundation unto the coping, and so on the outside toward the great court."—I. Kings, 7th chapter, 9th verse.

THE above is the oldest record we have of the use of machinery in dressing stone, and I have no doubt but that Hiram of Tyre would have used planers and molding machines, if some Yankee had happened along when his stone-cutters were on a strike, and shown him how much more and better work could be done by use of modern machinery than by hand labor.

Machinery, and machinery only, by lessening the cost of production, has made possible the many beautiful city fronts which we now so often see even in modern-priced residences and apartment houses, as well as in business blocks and public buildings.

Channeling machines cut the more valuable blocks from the quarry with less waste and less expense than by hand labor, and with much less injury to the stone than when the primitive methods of the churn drill and black powder were employed. And can any one say that there is any less skill required in the designing, constructing, and operating of channeling machines than in quarrying stone by hand labor?

And this calls to mind an incident of the early days of machine stone-cutting, in fact it relates to the first channeling machine, and, therefore,

may not be out of place here. Mr. Geo. Wardwell, the inventor of the channeler, in about the year 1860, was engaged in perfecting the machine, and for this purpose had taken it into the old quarry at Proctor, Vt. After working by the ancient method of using two cranks—one of iron and one human—and becoming satisfied that it would do the work, he had replaced the two cranks by using a second-hand engine and boiler. "Pop" safety valves and fusible plugs were then unknown, or at least none too common, and one day while the engine was stopped in order to change a gang of drills, the steam got a little too high and there being no other way to reduce the pressure an over-strained steam pipe kindly gave way. With a shout, "the biler's busted," all hands tumbled over each other in trying to see which would reach the quarry bank and safety first. One of the hand cutters on reaching what he considered to be a place of safety, turned around, and shaking his fist toward the steam channeling machine, exclaimed, loud enough to be heard above the roar of the escaping steam: "To — with yer, ye — old steam engine, cheatin' a man out o' his honest day's worruk; but, bejabbers, ye can't vote!" I cannot help wondering if the writer of "Machine vs. Hand-Cut Stone," in September *STONE*, may not be a descendant of the man who made the remarks quoted above.

The Hoosac Tunnel was finished about twenty years ago, more than thirty years after the work was commenced, and it is very likely it would still be in process of construction were it not for the genius of a Burleigh, in giving us the rock drill—commonly called by quarrymen the "gadger"—while the Mont Cenis, a tunnel much larger than the Hoosac, was cut through in a trifle over two years from its commencement, simply by employing modern rock-cutting machinery.

Electric drills and channeling machines are fast taking the place of steam ones, and we need not be surprised to see, at no distant date, stones cleft by electricity direct, without the aid of saws or steel tools.

The saw has been in use so long (evidently since the building of Solomon's Temple) that it needs no argument of mine to justify its worth. That it has been improved, and is still being improved upon, I have no doubt, although I have seen illustrations and read descriptions of short pitman gangs, similar to those of the present day supposed to be recent inventions, that were in use in Ireland more than one hundred years ago.

The use of planers, lathes, and machines using paring tools in working stone is of more recent date, but I have yet to learn of a single architectural effect being marred by use of such tools. I do know that a planer will cut finer moldings, in true lines, either straight or circular, and leave the stone in much better shape to stand the effects of time than it is possible for a stone-cutter to do it. By use of a mallet and chisel, I call to mind an instance where the architect's plans for a beautiful library building called

for the stones to be placed on their natural bed. There was a heavy molded belt-course which projected several inches, and as usual in such cases there was a "drip." Said "drip," set back from the face about one inch, was about an inch and a half deep, and rounded out on the back to about an inch



NEW YORK AND NEW JERSEY TELEPHONE BUILDING.

and a half wide. Now the contractors of this particular job had no planers, "did not believe in them;" said "planers were no good on this kind of stone, they 'stunned' and 'shook' the stone," etc., etc., as men who know nothing about it will sometimes assert, and they started in to cut by hand.

Now it happened that the stone they were using was of a kind easily split into sheets and thin slabs "bed way" and when they came to cut the "drip" they strained the stone so that three or four feet at a time of finished molding came loose. This was discouraging even to contractors, and on the advice of friends they decided to try planers, with the result that they did not unloose another foot, and turned out more and better work than had previously been done by hand.

Another: A job of wainscoting was done in marble. The base was $\frac{7}{8}$ " thick and had a groove cut in the upper edge $\frac{1}{4}$ " wide by $\frac{3}{8}$ " deep to receive panels. Think of this groove being cut to any advantage by hand! Still it was successfully done on a planer in a short time without the loss of a single inch.

Still another: Several large panels were to be cut in white marble. The slabs were $1\frac{1}{4}$ " thick by about 4'x6' and the panels were to be sunk to about $\frac{3}{8}$ " thick on the back. What headway could a stone-cutter make with this kind of a job without straining the back of the panel and spoiling the work? These panels were successfully cut on a planing machine and the work more evenly done than hand labor which would have cost twenty times as much.

The planing and moulding machine is still in its infancy, yet there are a great many enduring examples of its work. The New York and New Jersey Telephone Building (illustrated on page 309) erected in Brooklyn, N. Y., last year, will stand not only as a lasting monument to its architect but to the planing machines by which the work was done. All the straight as well as circular arches and bows were cut on planing machines. The city court house, now nearing completion in Baltimore, Md., the Rhode Island Capitol Building, at Providence, will both testify to the excellence of the work of the stone planing machines.

F. R. Patch.



PRACTICAL TONE-CUTTING.—XI.

EXPLANATION OF THE CONSTRUCTION OF A REPRESENTATION OF A SOLID, SHOWING THE DEVELOPMENT AND ACTUAL POSITION OF BED AND JOINT SECTIONS, OF A PIECE OF COPING, THE PLAN OF WHICH IS GREATER THAN A QUARTER CIRCLE, THE RISE OR INCLINATION OVER THE PLAN TANGENTS BEING UNEQUAL.

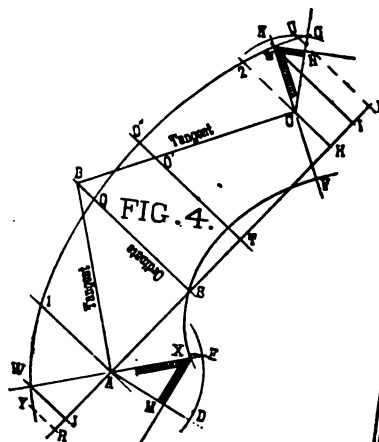
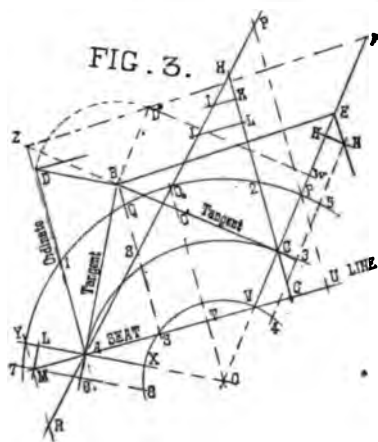
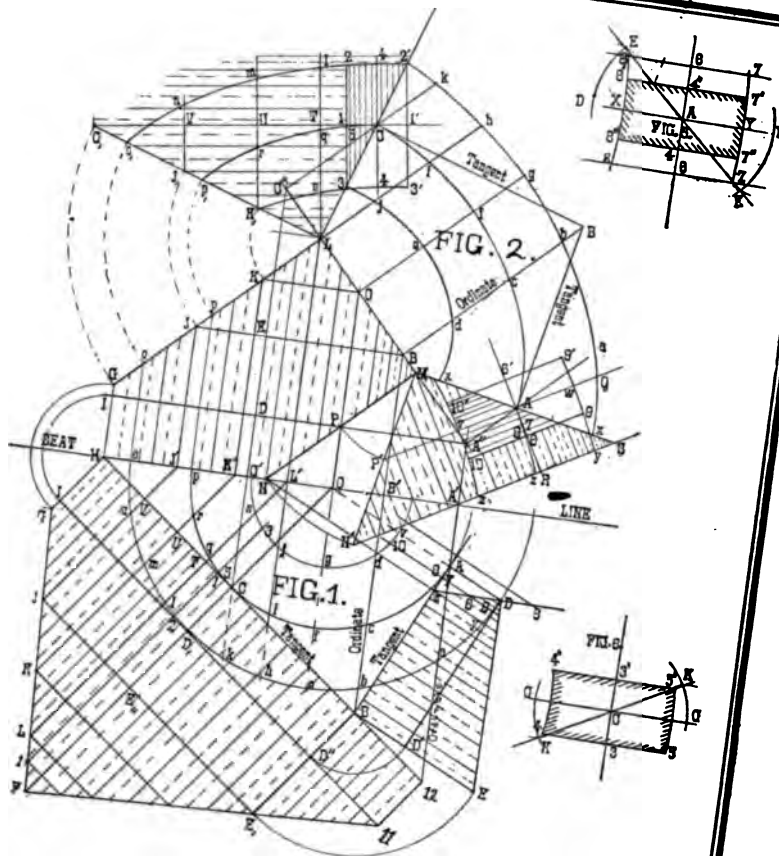


THE problem to be explained at this and plate following is thought by a great number to be the most difficult one in handrailing. However, the geometrical principles, as applied to the development of the joint and bed sections of the preceding constructions, are those to be employed for the similar purpose at these drawings, and if the student has thoroughly mastered the explanations as given at Plates 7, 8, 9, no difficulty will be experienced in working out the problem now before him. In Fig. 1 O represents the plan center, A—f—C the center curve, and the points A—C are those at which joints are desired. The plan curves, joint lines, and the tangents A—B—C may be projected in the manner the like operations may have been drawn in preceding plates. At this example the greater rise has been placed over the upper tangent; at the example which follows the greater rise will be placed over the lower tangent.

(The means to be employed for the ascertaining of the several inclinations over the tangents will be shown at the explanations of the work of a practical nature which shortly follows.) Understanding this: The student will in the manner already explained for the purpose of showing the lower joint surfaces, set off at his drawing a height corresponding to that given in A'—A'', of Fig. 2; and A—D, B—D', B—D'', and C—D,, of Fig. 1. Then set off D'—E, D''—E, and D,—E,,, as equal to the rise of the coping over the lower tangent, and set off a greater height as that of E,,—F, of Fig. 1, as the rise of the coping over the upper tangent. To find the position of the directing ordinate of the plan: Parallel with tangent B—C, through D,—E,,, produce D,—11 and E,,,—E₁; then square with tangent produce B—E₁. Draw from F, through E₁, meeting D,—D'', produced in 11; then parallel with B—E₁, draw 11—12. Joining 12 with A and producing it, the position of plan ordinate may be obtained. * Parallel with this draw the plan ordinates; and in Fig. 2 set off D—C'' equal to the total rise D,—F of the coping, and joining C''—A'' the full inclination of the section plane may be obtained.

*Copyrighted, 1897, by Chas. H. Fox.

PLATE 10.



The elliptical curves of the bed and joint sections may now be projected, and the model formed in the manner fully explained for the like operations at other models.

In Figs. 3, 4, 5, 6 are shown the methods to be adopted in practice for the projecting of the bed and joint moulds. In Fig. 3 O represents the plan center, A—C the center curve and also the points at the plan over which joints may be desired. Having drawn the tangents A—B—C, produce C—B indefinitely. Then square with the tangents draw B—D and B—D'', equal to the rise of coping over the tangent A—B. Join D—A and the inclination over the tangent may be ascertained. Then parallel with B—C draw D''—W. Set off W—F equal to the rise of coping over the tangent B—C. Draw F—D'' meeting C—B produced in Z. Joining Z with A and the position of the directing plan ordinate may be obtained. Square with this draw the seat line through A. Then through C square with seat draw G—H equal to the total rise of coping. Join A—H and the full inclination of the section plane may be obtained. Now produce plan ordinates to meet R—P. Then in Fig. 4 set off R—A—S, etc., equal to the divisions given in R—P, of Fig. 3; square over ordinates, find points, and trace the elliptical curves; draw tangents and joint lines in the manner fully explained for the like operations at Plate 9. Now to project joint sections: In Fig. 4 square with R—P draw W—J, and C—H, W—I. Then in Fig. 3 set off H—I, H—J equal with H—I and A—J, of Fig. 4. Then parallel with A—G draw J—L, I—K. Then set off E—K equal with H—K, and A—L equal with H—L. Then draw E—N and A—M square with B—E and D—A. Then parallel with the tangents draw K—N and L—M. Then with W of the upper joint as center, and E—N as radius, draw an arc in N. Then make C—N equal to the half width of coping, and through N draw the lines W—N, C—N, which give the positions both of a level and a plumb line at the surface of the joint. Repeat the operation with X of the lower joint as center and A—M as the radius, and the positions both of a level and a plumb line may be ascertained. The joint sections are shown developed in Figs. 5 and 6. The method by means of which the curves may be drawn has already been fully explained, therefore a repetition is unnecessary. E—N, of Fig. 3, C—3 and A—4, of Figs. 5 and 6, are each equal to the half thickness of the coping, and A—6, of Fig. 6, is equal to A—M, of Fig. 3.

Charles H. Fox.

THE CHATSWORTH BRIDGE.*

WHILE there is nothing especially remarkable about the Chatsworth bridge, it is a typical example of English Palace accessories in bridge engineering. As Chatsworth House is regarded the most splendid private palace in England, it is to be expected that the bridge would be somewhat too ornate. It is almost entirely a piece of architecture, as the engineering problems involved in its construction are of a very simple character.

The piers are well proportioned, and are capped with elegant moulded copings. The springing of the arch is well defined and the arch ring is neatly emphasized by a molded archivolt.

The statuary over the pier starlings is entirely out of place in bridge design, but it must be admitted to be in perfect harmony as part of a group of architectural works.

The beautiful coping and balustrade are of such elegant design as to be worthy of much study and imitation. The abutments are elegantly defined and it is to be regretted that a work otherwise so deserving of commendation, should have its beauty impaired by the broken profile of the roadway, which could easily have been avoided by a gentle curve and another element of elegance added.

"F."

THE MAIDENHEAD ARCHES.

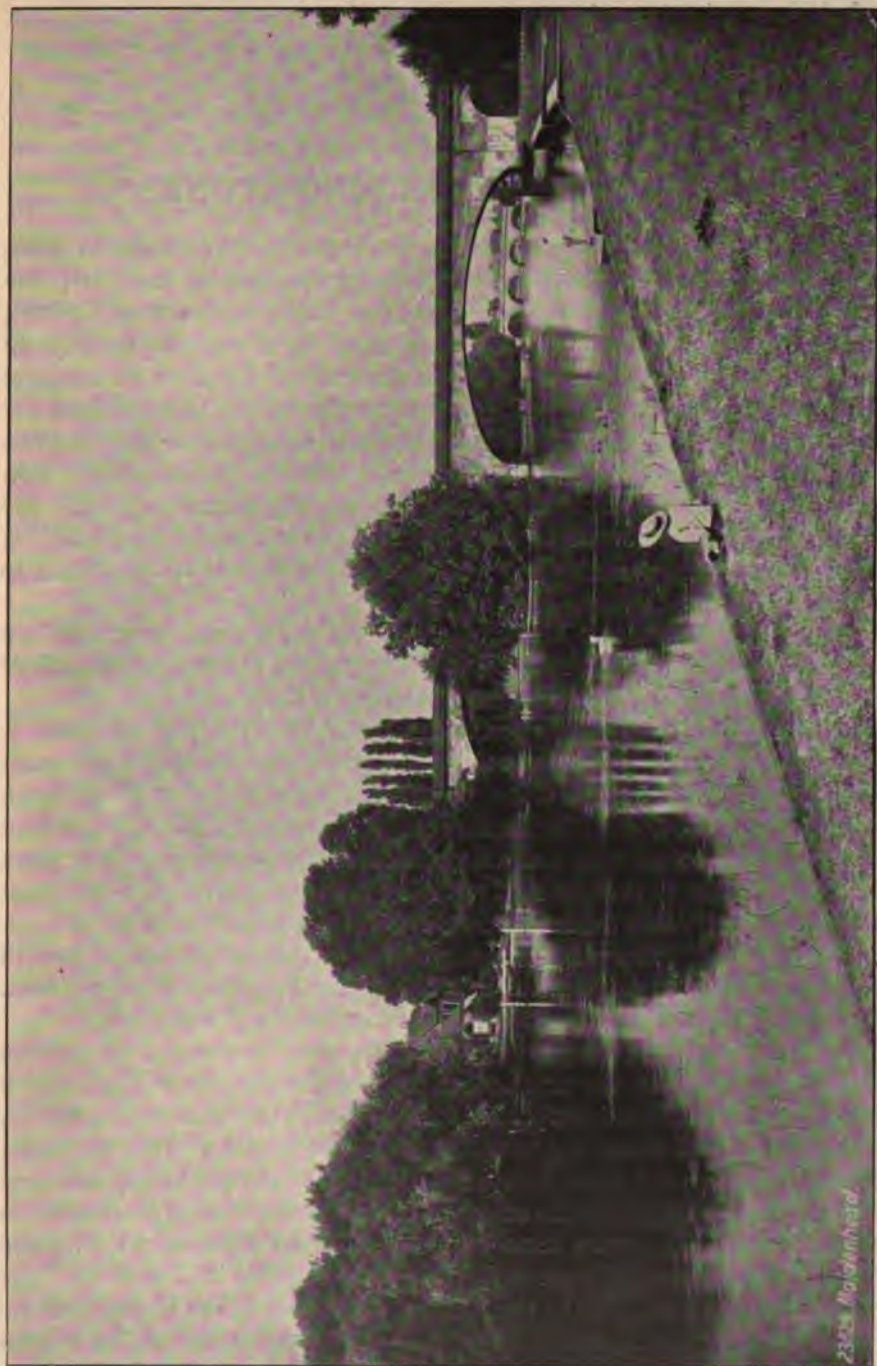
THE railway bridge at Maidenhead, England, constructed by Brunel, in 1837, is an example of the grandeur given to engineering works by simplicity of design. The two large arches are elliptical, with a span of 128 feet, a rise of 24.2 feet, and a depth of key of 5.3 feet.

The spandrels are built with longitudinal voids—the bridge being of brick laid in cement. The curve of the intrados is very graceful and the whole effect is one of boldness. The parapets are well proportioned and afford the relief necessary, while the abutments are finely accentuated by the twin pilasters.

The prevalence of such work gives an air of completeness to a landscape and one has reasonable expectation of seeing other evidences of civilization in its neighborhood; and this is not disappointed, as the arch bridge seen through the large span forms part of another landscape set in a frame of masonry.

"F."

*Subject of Frontispiece



THE MAIDENHEAD BRIDGE, MAIDENHEAD, ENG.

2328 Maidenhead.

TESTS OF IOWA BUILDING STONES.*



THE tests whose results are given in this paper was made in 1897, under the direction of the writer, by students in the Civil Engineering Department of the Iowa State Agricultural College, as thesis work. The tests were made by Messrs. R. H. Hollembeak and W. M. Jones. The department proposes to continue and extend these tests as opportunity offers, though some experimental work will first be done in investigating certain questions which have arisen concerning some of the methods of testing to be employed. The few results already obtained are presented now because so little data from tests of Iowa building stone are available that even a small number of results ought to be made accessible at once.

The specimens of Iowa building stones for these tests were obtained through the courtesy of the Le Grand Quarry Co., Quarry, Iowa, and of the Warden of the State Penitentiary, Anamosa, Iowa.

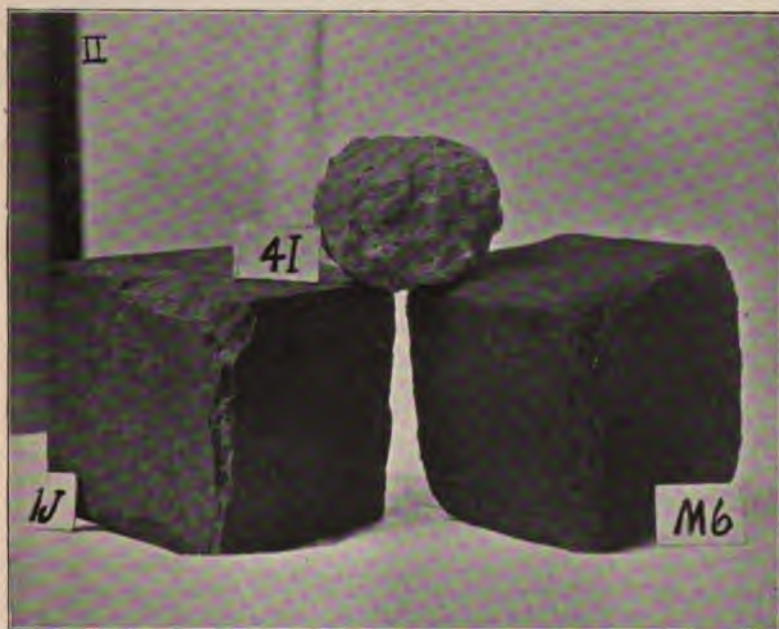
From the Le Grand stone specimens 1J, 2J, 3J, 4J, 5J, 6J, of Table I. were prepared. The tables gives their respective characteristics and positions in the quarries. This stone belongs geologically to the Kinderhook formation of the Lower Carboniferous. The quarries are in Marshall County, near Marshalltown, and are quite extensively worked. The "Iowa Marble," of Table I., is capable of receiving a fine polish, and is often beautifully veined with iron oxides. Hence it is of considerable value for ornamental purposes. The other ledges are used for heavy masonry. Merrill gives as the main constituents of this magnesian limestone 75.42 per cent. of carbonate of lime, and 20.96 per cent. of carbonate of magnesia.

From the Anamosa specimens 1A, 2A, 3A were prepared. These were intended to represent the product of the quarries near Stone City, which are commercially the most important in the state. The stone is a dolomite, and many years of actual use have shown it to be durable. It is very completely laminated, and must always be placed on its natural bed in masonry. The main effect of the weather seems to bring out the lines of lamination on the surface. The quarries have been described by Professors Calvin and Norton in the Iowa Geological Survey Reports, Vol. IV. and V. The stones belong geologically to the Niagara formation of the Upper Silurian. The exact positions in the quarry from which specimens 1A, 2A and 3A

*From report of Proceedings Iowa Engineering Society, January 19, 1898. 316

were taken are not known, but this is of less importance on account of the uniformity of the stone. Professor Calvin says "the quarry beds of this region are not definitely divided into layers. Throughout their whole thickness they constitute practically one layer." Merrill gives two analyses of this stone, whose average shows 57.59 per cent. carbonate of lime, and 39.50 per cent. of carbonate of magnesia to be the main constituents.

Perhaps the main value of laboratory tests of building stone is for comparative purposes, to show whether the material is better or worse than some other stone well tried by actual use. Hence it was thought desirable to obtain specimens of extensively used building stones from neighboring



states, and subject them to exactly the same tests as were made on the Iowa stone. Through the courtesy of the authorities of the Illinois State Penitentiary at Joliet, Ill., samples were obtained from which specimens 4I, 1B, 2B, 5O, 3S, 6M were prepared. 4I is a sample, presumably from the state quarry of the Joliet limestone so extensively used in Illinois. It is a dolomite of the Niagara formation. 1B and 2B are sample of the noted Bedford limestone, so extensively used for masonry structures throughout the Mississippi Valley. This is an oolitic limestone from the St. Louis group of the Lower Carboniferous. 5O, 3S and 6M are samples of sandstones well known and much used in masonry structures.

From each block of these different kinds of stone two two-inch cubes were cut with a carborundum wheel. One set of cubes was at once crushed between adjustable steel plates, in a 100,000 pound Riehle testing machine. The other set was used for the specific gravity determinations, and the absorption and the freezing and thawing tests. The specific gravity determinations were based on the weights when the cubes contained the normal amounts of moisture, but before being immersed for the absorption tests they were dried in an oven until successive weighings showed no further loss of water. All weighings were to 0.01 gram. At the close of the absorption tests the cubes were placed, while still saturated with water, in a freezing box. In this box a temperature of from 4 degrees below to 2 degrees above Fahrenheit was constantly maintained by the free use of salt and ice. The cubes were then thawed for twenty-four hours in water at a temperature of about 77 degrees F. This process was repeated twenty

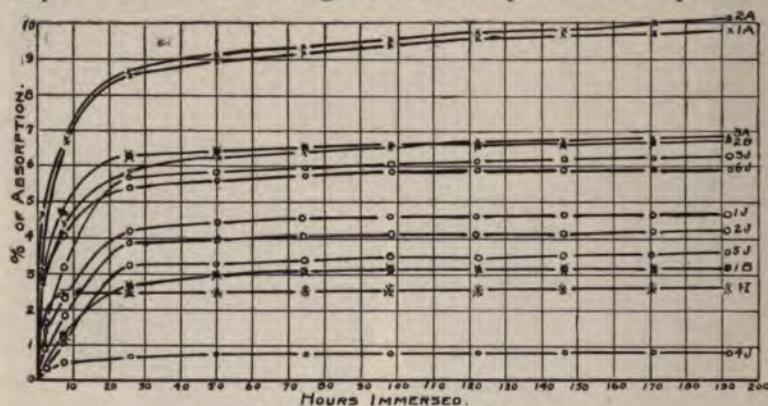


PLATE I. STONE TESTS.

times, record being kept of all visible signs of disintegration. At the close of the twentieth time the cubes were again dried in an oven and weighed, after which those showing no visible signs of disintegration were crushed in the Riehle machine.

The main results of the tests are given in Table I. The complete details of the absorption tests of the limestones appear on Plate I. The disintegration of the cubes at the end of the tenth freezing test is shown on Plate II., and at the end of the twentieth on Plate III. The disintegrations of the different specimens began at the following times: 4I, second test; 1J, fourth test; 6M, fifth test; 3J, eleventh test; 5O and 3S, 13th test; 2B, seventeenth test.

In 1896 Messrs. G. W. Zorn and J. W. Elliott, also students at the college made a series of tests of the Le Grand Quarry Company stone under direction of the writer. The samples were collected by the students per-

IV



IV



TABLE I.

Laboratory No.	Locality.	Kind of Stone.	Crushing Strength, lbs. per Sq. In.		Per cent. of Absorption in 192 hrs.	Per cent. loss in weight freezing 30 Times.	Specific Gravity.
			Before Freezing.	After Freezing 30 Times.			
6J	Le Grande, Iowa.	Buff Fossiliferous Limestone (Above 5J).	6640	5670	5.96	0.03	2.288
5J	" "	"Iowa Marble" Buff Limestone, Veined (Above 3J).	12100	12625	3.61	0.07	2.454
3J	" "	"Caen Stone" Buff Magnesian Limestone (Above 4J).	6600	—*	6.26	4.65	2.304
4J	" "	Hard Blue Limestone (Above 2J).	23985	26200	0.83	0.06	2.451
2J	" "	Gray Oolitic Limestone (Above 1J).	7440	6380	4.21	0.03	2.396
1J	" "	Gray Blue Calcareous Sandstone.	6805	—*	4.66	1.85	2.121
1A	Stone City, Iowa.	Warm Gray Dolomitic Limestone Quarry.	3375	4185	9.77	0.18	2.029
2A	" "	" "	3500	5000	10.06	0.10	2.073
3A	" "	" "	9040	6360	6.86	0.02	2.158
4I	Joliet, Ill.	Light Drab Limestone.	17935	—*	2.60	100.00	2.594
1B	Bedford, Ind.	Bluish Gray Oolitic Limestone.	7385	9844	3.16	0.10	2.440
2B	" "	Buff Gray Oolitic Limestone.	4640	—*	6.79	1.03	2.221
5O	Berea, Ohio.	Fine Grained Gray Sandstone, Berea Grit.	10610	—*	6.43	0.38	2.207
AS	Superior, Wis.	Brown Red Sandstone.	6000	—*	7.34	3.77	2.070
6M	Portage Entry, Mich.	Red Sandstone.	7130	—*	6.86	1.84	2.137

*Not broken because so badly disintegrated. See Plate II and III.

TABLE II.—TESTS OF LE GRAND QUARRY CO. STONE.

Stratum.	Quarry.	Crushing Tests.				Absorption in 180 hours.			
		Laboratory No.	Strength Lbs. Sq. In.	Laboratory No.	Strength Lbs. Sq. In.	Laboratory No.	Per Cent.	Laboratory No.	Per Cent.
6J	North Quarry.....	11	.....*	12	.....*	3	1.79	2	0.77
"	".....	.....	.....	.....	.....	7	1.32	.....	.....
"	South Quarry.....	15	.....*	26	15940	.....	.....	.....	.....
"	West Quarry.....	28	9773	31	15940	30	1.83	29	1.70
5J	North Quarry.....	1	9390	.....	.....	25	6.54	.....	.....
"	South Quarry.....	36	10375	35	10400	13	5.10	.....	.....
"	".....	37	10930	.....	.....	.....	.....	.....	.....
"	West Quarry.....	16	15360	.....	.....	19	3.92	17	3.63
"	".....	.....	.....	.....	.....	18	4.70	.....	.....
3J	North Quarry.....	10a	10825	9	11055	8	4.53	49	5.55
"	South Quarry.....	39	.....*	42	.....*	41	1.50	40	2.69
4J	North Quarry.....	27	.....†	24	.....†	10b	2.03	.....	.....
"	Timber Creek Quarry.....	33	8712	34	8383	32	3.20	45	5.35
2J	North Quarry.....	4	13450	5	14970	20	2.75	21	4.05
"	".....	6	10260	.....	.....	.....	.....	.....	.....
"	South Quarry.....	22	12740	23	14250	38	2.62	44	2.21
"	".....	43	13250	.....	.....	46	2.66	.....	.....

*These specimens stood 16,500 lbs. per square inch without crushing.

†These specimens stood 15,500 lbs. per square inch without crushing.

sonally, under the direction of Professor S. W. Beyer, who was given permission to use the results of the tests in his report on the geology of Marshall county, in Vol. VII. of the Iowa Geological Survey Reports. In condensed form these results are given in Table II.

The results given in Table II. are interesting as indicating that a very considerable variation may occur in the physical characteristics of the stone from the same ledge in the same quarry and in neighboring quarries. This makes clearly evident the futility of trying to draw conclusions as to the quality of a building stone from the results of one or a few tests. The complete absorption tests made by Messrs. Zorn and Elliott would plat into curves like those of Plate I. For each stratum these would "scatter."

As regards additional tests of the Anamosa stone, it may be said that one of the quarry companies publishes a test by Gen. Flagler, made in 1882, which gave a crushing strength of 5,917 pounds per square inch, and 6.35 per cent. of absorption in 24 hours. In 1896 the writer made nine crushing tests of this stone for the Iowa Geological Survey, six of which fell within the range of the results given in Table I. for 1A, 2A and 3A, while the three others were higher, ranging up to 13,400 pounds per square inch.

In studying the results of the above or any other tests of building stones, it should be clearly understood that the crushing strength is simply an indirect means of finding out something about the nature of the internal structure of the stone. It very seldom, perhaps never, occurs that the stone in a masonry structure fails by direct crushing. Even when the stone is overloaded, which very seldom happens, it generally splits from unequal bearing, bringing into play the tensile rather than the crushing strength of the material. But as an indication of a firm dense structure, a high crushing strength is so much evidence in favor of the good quality of the stone. Thus in the case of the Bedford limestone and the Le Grand limestones of Table I., the specimens which disintegrated were comparatively weak.

The absorption test is also an indirect test, whose use is to show whether the structure of the stone is porous enough to admit of sufficient water being taken up to make freezing dangerous. In both of the cases just cited above, the specimens which failed showed high percentages of absorption.

But both the crushing and absorption tests may fail to bring out the most important facts as to the structure of the stone. This is especially apt to be the case in comparing stone of different kinds, or from different places. Thus specimens 1A and 2A in table I. were only about one-fifth as strong, and were about four times as porous as 4I. Yet they were not visibly affected by freezing and thawing twenty times, while 4I began to disintegrate badly at the second test. It is probable that the failure of 4I was

due to invisible seams of fine clay, while the structure of 1A and 2A may have been so open as not perfectly to confine the freezing water.

The chemical analysis of stone, and the microscopical examination of sections ground so thin as to be transparent, are other indirect tests to determine the structure. It is very difficult, however, to grind specimens of soft sedimentary rocks thin enough for microscopical examination without their flying to pieces.

On the other hand the freezing and thawing test of building stone is a direct test, intended to subject the material to the direct action of the same agencies which usually cause its destruction. The objection is the time required to carry out the test, but although it must be carried on for two months or more, only a few minutes are required for the work each day. Any good mechanic can make the freezing box, which is all the apparatus required for this test. A zero temperature can easily be maintained by the free use of salt and ice. There are many interesting questions, however, in connection with this test which remain to be studied. Among these may be mentioned whether greater effect will be produced by greater cold, whether different results would be obtained with different sized cubes, whether rough blocks or smooth cubes should be used, and how long the specimens should be left in the box each time.

The chemical tests with acids, to determine the effect of city atmospheres, and the plunging of heated cubes into cold water to determine the effect of unequal heating and cooling, are other direct tests of building stones.

Prof. Anson Marston.

STATISTICS FOR STONE TRADE FOR 1896 AND 1897.

FROM the forthcoming report of United States Geological Survey, Division of Mineral Resources, we extract the following statistics relating to the industries represented by STONE:

PRODUCT.	1896.		1897.	
	QUANTITY.	VALUE.	QUANTITY	VALUE.
Building stone*.....		\$ 31,346,171		\$ 36,070,651
Cement† (barrels).....	9,513,473	6,473,213	10,989,463	8,178,283
Phosphate rock (long tons).....	930,779	2,803,372	1,039,345	2,673,202
Limestone for iron flux (long tons)...	4,120,102	2,060,000	4,247,688	2,124,000
Gypsum (short tons).....	224,139	572,344	288,982	755,864
Grindstone.....		326,826		368,058
Soapstone (short tons).....	22,183	354,065	21,923	365,629
Oilstone, etc. (pounds).....		127,098		159,970
Grand total.....	14,810,676	\$ 44,063,089	16,587,401	\$ 50,695,657

*Not including limestone for iron flux, or grindstones.

†Of 300 pounds for natural cement, and 400 pounds for artificial Portland.

THE NORTH CAROLINA AVENUE CONCRETE SEWER, WASHINGTON, D. C.

THE sewer was built by the Commissioners, Capt. Lansing H. Beach, U. S. A. Engineers, in charge; Alexander Crawford Chenoweth, Contractor.

The size of sewer was 3'37"x2'2" egg shape, 9" thick, with a terra cotta invert block in bottom, and two rows of vitrified brick. Length of sewer, 799 feet. The concrete from which the sewer was built consisted of the following proportions: 1 barrel of American cement, 2 barrels of sand, 4 barrels of gravel. The 799 lineal feet of sewer consumed the following quantities of material:

49 cubic yards of cement at \$7.69 per yard.....	\$ 376.90
154.6 cubic yards gravel at \$1.15 per yard.....	177.79
79.8 cubic yards sand at \$1.00 per cubic yard.....	79.81

When mixed 283.4 cubic yards material in concrete, total cost.....	\$ 634.50
Labor employed was paid \$1.25 per day of 8 hours. Eight men were mixers and handlers of cement, four men were employed in winding and handling the centering. Total cost of labor \$687.14, one-third of which was for handling the centering, and two-thirds for mixing and handling cement.....	687.14

Total cost of concrete in place, or actual cost of main sewer exclusive of excavation of trench and timber bracing..... \$1,321.64
Total cost of concrete in place 284 cubic yards \$1,331.65 or \$4.68 per cubic yard or \$1.65 per foot of sewer built.

The following items of cost enter into the construction of this sewer, which are additional and incidental:

Brought forward.....	\$1,321.64
Two rows of vitrified brick, 6,392 brick \$15.50 per M.....	124.64
799 feet of invert terra cotta block.....	341.40
For excavating and backfilling timber bracing, 799 feet of trench of 16 feet deep, material hard conglomerated clay, but liable to flake, of regular bracing, 2,255 cubic yards at 70 cents.....	1,587.13
The specification called for a covering of the outside arch of sewer to spring line with a coating $\frac{3}{4}$ thick of Portland cement, mixed with sand, proportion 1 to 1. Also inside of sewer to spring line: This required	
Forty-five barrels Portland cement.....	\$116.10
Thirty cubic yards sand.....	31.50

Including labor.....	147.60
----------------------	--------

\$3,522.41

Total cost of sewer \$4.41 per foot of sewer built.

The sewer was built by means of the Chenoweth centering, which con-



FIG. 1.

sists of a collapsing wooden centering wound with a spiral band of cold rolled steel 6" wide and $\frac{1}{2}$ of 1" thick. This band is fastened to wooden centering at ends to prevent unwinding. The centering is then given a coat of oil. The coat of oil serves a purpose to be explained hereafter.



FIG. 2.



FIG. 3.

The centering as above described is now ready to put in place. The bottom of sewer being brought to grade, and concrete laid so that the terra cotta invert blocks when placed are at grade, the centering being placed thereon was packed about with concrete lowered in buckets. The work

progressed until the centering was completely covered. At this stage the wooden mandrel is collapsed and removed, leaving the steel band to perform the function of sustaining the concrete until hard when the band can be drawn out and used over.

The operation is repeated over as many times as desired.

In constructing this sewer the centerings were sixteen feet long and quite heavy, but readily pushed to the derrick as shown in photograph,



FIG. 4.

when all the moving and placing was done by derrick. It was found the surface of steel band, when oiled, made a perfectly smooth surface for inside of sewer, and by giving the centering a coating of soft mixture of concrete and sand a remarkably smooth interior was the result. The time required to lay a sewer by this method was very short, as eighty to ninety feet of sewer per day was easily accomplished. The excavation and bracing proved slow and tedious by reason of the material. Very rapid work can be done in the way of building concrete sewers by this method,



FIG. 5.

as well as economical. A saving in concrete could be made by not building the sewer nine inches thick, five inch would answer as well.

FIG. 1.—Shows centering about to be lowered into place in the trench, the eye bolts at end that serve to hold the steel ribbon, and serve to fasten a sling rope to.

FIG. 2.—Another view of the centering.

FIG. 3.—Gives a view of the collapsing rods, how arranged.

FIG. 4.—Shows a piece of sewer built and a centering in place ready for concrete.

FIG. 5.—Shows the wooden centering withdrawn with steel band holding the cement in place, ready for another centering. The wooden lagging projecting on ends was to procure space for plastering the inside of sewer from brick line invert to spring line. This was done more in the nature of an experiment as it was found the plastering could have been put on without any reduction in size of sewer.

FIG. 6.—Shows a centering wound, the winding arrangement, center winding rod and end rests. The rods projecting at end are the collapsing rods, and serve to tighten the ribbon on the centering; by driving these rods in, say two inches, they will drive apart the centering which tightens up the steel band. To continue driving it would collapse the centering, this being done when the centering is in the ditch and covered with concrete.

Alexander Crawford Chenoweth.



FIG. 6.

USE OF STONE IN BUILDING.*



IN all times and in all countries when man would raise a great and enduring work, stone has been employed whenever it could be obtained, and in our time and country if we would erect a great public building, a noble university or a stately church, we rightly choose the same material. For the smaller buildings, where the economy of money is more essential, and the total life of the building of less consequence, cheaper and less durable materials are rightly used. There are also in our country, regions where stone is so rare or of such poor quality that building rock if used at all must be shipped in. Here the cost of transportation will always place it at a disadvantage in competition with other materials, and preclude its use for any but the most expensive structures. In such areas wood and clay goods become its rivals even within its own proper sphere, but as a rule there is but little competition. Each building material is within its own sphere supreme. For cottages and individual buildings of small size wood must always be most largely used, even though equally good effects might be produced with either stone or brick; for city residence blocks and store and office buildings, clay goods are usually to be preferred; but for the larger and more massive individual buildings, where dignity and permanence are valued, stone must always stand supreme, the best building material.

In the selection of the best stone for an individual piece of work our architects and engineers have a wide range of choice. There is hardly a state in the union which does not produce a considerable variety. All the different sedimentary and crystalline rocks are available in the markets of any of our larger cities. To choose wisely from this wealth of material is often a perplexing task. This is true because of the vast interests concerned. Works in which stone is used are rarely those in which small amounts of money are involved. A single contract may make the difference between success and failure in the development of a property. In any event a large contract will keep the whole quarry force busy for some time. Thus large personal and economical interests are involved.

Our engineers have before them a more difficult problem than that faced by the Egyptians and other early workers, in the matter of climate. Not only is our climate in itself more trying than that of the semi-tropical

*H. F. Bain, in Annual Report of Iowa Geological Survey for 1897.

southern countries in which the early builders worked, but the great size of our country and the modern development of transportation facilities results in a given stone being far more widely used than was any from the ancient quarries. We no longer build from stone quarried within a few miles of our building site, and hence cannot argue that the rock having stood for untold centuries in the quarry may well be expected to stand in the building. Our stone may be shipped so far as to be used under totally different climatic conditions from those affecting it in its native exposures.

Again, modern conditions of life are producing a marked effect on our climate. Particularly is this true in our cities where under present conditions so much of the stone must be used. Our universal use of steam, the great amount and often poor quality of coal burned, the imperfect combustion obtained, the large number of industries which, in the production of their wares, use chemical processes of some nature, all exert a marked influence on the purity of the air. It is doubtful if any stone used by the older builders was ever called upon to stand the insidious influence of so tainted an atmosphere as that to which our stones are exposed as a result of purely artificial conditions alone. This, coupled with the many trying natural conditions of humidity, variation in temperature, wind action, and unequal settling, all make the wise selection of stone a matter requiring much thought and a wide range of information.

The very variety of material is in itself confusing. Such wide differences exist in the nature of different rocks that choice between them is not always simple. The property which, in one stone or in one position, may be an advantage, becomes under other circumstances a positive disadvantage.

A rock is not a simple substance. It is not even a definite chemical compound, and is very rarely a simple mineral substance. It is rather an aggregate of minerals which may or may not be themselves simple substances, and which, in fact, very rarely are simple in composition. In strict scientific sense rock is defined by Geike as follows: * "A mass of matter composed of one or more simple minerals, having usually a variable chemical composition, with no necessarily symmetrical external form, and ranging in cohesion from loose debris up to the most compact stone." It is in this sense that the word rock is used in geology. In common usage, however, the term is restricted to consolidated beds. It is also true that the word rock is more commonly used in speaking of large masses while still in the ground; while to smaller pieces and to the quarried and dressed product, the corresponding term stone is applied.

There is an immense number of varieties of rock. The classification of these varieties may be upon a number of different bases. It may be (1) a

*Geike: *Text-book of Geology*, p. 61, third Ed., London. 1893.

classification based upon composition, either chemical or mineralogical, yielding such names as calcareous and plagioclase rocks; (2) it may be structural and lead to such terms as stratified and unstratified; (3) it may be genetic, and so we have volcanic and organic deposits or rocks.

Without attempting a complete or thoroughly scientific classification it will be sufficient for present purposes to consider rocks as either (1) Crystalline, or (2) Clastic.

Crystalline rocks.—In this class may be placed all those rocks in which the constituents exhibit wholly or to a marked degree, a crystalline nature. It includes such rocks as granite, gneiss, syenite, and other similar forms. The granite boulders and related rocks found in the drift and sometimes utilized in Iowa, belong to this group. It is not, however, in this state an important class, most of the stone belonging to it and used here being imported.

Clastic rocks.—This series includes the major portion of the rocks of Iowa. A clastic rock is one which is made up of small fragments of pre-existing rocks newly cemented together. It may, in time, become so changed through metamorphism that it is indistinguishable from a rock which was originally crystalline. A very great number of rocks which are usually classed with the crystallines and studied with them belong in origin to this group. An example of this occurs in our state in the Sioux quartzite. This rock is known to the trade as the "Sioux Falls granite," though it is in reality not a granite either in composition or origin, but rather a sandstone which has been changed by the secondary growth of the quartz grains into a very hard, closely compacted crystalline.

Similar examples may be found in the limestone series. Marble is but limestone which has been re-crystallized through metamorphism. We have in Iowa no extensive deposits of true marble. There are, however, small areas which show the beginning of the change, and frequently bodies of rocks of quite thoroughly crystalline type are found. In order to distinguish these phasal developments from crystallines in the ordinary usage of the term they may be called sub-crystalline. The clastic rocks of this state form two main series: (1) sandstones, (2) limestones. The quartzites may be considered as a subordinate group under sandstones, and the gypsum, while not a limestone, may, because of its closely related origin and small importance as a building stone, be classed with them. The clays, gravels, shales, and similar beds, while as truly rocks as any of the foregoing, are not usually considered as building stones.

H. F. Bain.

Iron and Steel vs. Stone in Bridge Construction.

In concluding a most interesting article on European and American bridge construction in the *Engineering Magazine*, the author says the question how long steel and iron bridges will last becomes most important, because the time must come when they cannot be replaced. Will they last as long as stone bridges, of which some two thousand years old are yet in use? The answer can be given now with as much certainty as one thousand years hence. A strong and well-designed iron or steel bridge, effectually protected against corrosion will endure many centuries—in fact, should endure forever. But the qualifying conditions are important ones. By a strong and well-designed structure is meant one in which every part is secure as shown by calculation against overstraining of the metal, within now well-known limits, from any loads or forces that may legitimately affect the structure. The alleged crystallization and final brittleness of iron and steel, through long continued use and vibration, is a fable unworthy of scientific belief, because unsupported by germane facts. It originated from the frequent fracture of overstrained and abused metal, in which the proper limits of allowable stress were not observed. Iron so overburdened will break down, vibration or no vibration, just as an overburdened horse will break down. The familiar legend of the fiddler, who could, if persevering enough, fiddle down a bridge, which is meant to be metaphorical of the destructive force of cumulative rhythmical oscillations, need cause no apprehension that a strong and properly-designed metal bridge can ever suffer or break down under the regular step of a regiment marching to music. A metal bridge can be made just as safe in that respect as a stone bridge. With stresses in iron and steel not exceeding one-third to one-tenth of the breaking strength, the durability will surpass that of a stone arch bridge, in which the pressures usually range from one-tenth to one-twentieth of the breaking strength of the stone, provided that the one other

condition, protection against corrosion, be observed. This, it must be admitted, has been so far found a difficult, if not impossible, condition. Good stone requires no such protection. Well built stone masonry will slowly deteriorate through ages, as the rock of mountains deteriorates, through the action of changing heat and frost, rain and wind. But, while iron and steel resist temperature influences better than stone, they suffer more from the chemical action of water and air, and particularly from the acidulous gases and moisture, for the exclusion of which from the iron surfaces no known paint gives prolonged protection.

The Monon's Stone Traffic.

At the first annual meeting of the Chicago, Indianapolis and Louisville (Monon) railroad held in Indianapolis, the proposition for the company to guarantee the bonds of the Indiana Stone Railroad Company was considered. Arrangements were reported being made to control the business of the Consolidated Stone Company, which owns valuable stone properties in Lawrence and Monroe counties, Indiana. They have been developed into valuable and large producing stone quarries, that furnish a large per cent. of the freight of this company, the earnings from which amounted to \$161,160 for the year ending June 30, 1898.

The Pumice Stone of Lipari.

Mr. Norman Douglass, one of the secretaries of the British embassy in St. Petersburg, who has been traveling in the Lipari Islands, has transmitted to the Foreign office, as the result of his journey, some interesting particulars concerning the pumice stone industry.

Pumice occurs on most shores of the Tyrrhenian Sea and elsewhere, but that of commerce is at present almost exclusively obtained from the island of Lipari. It is a trachytic lava, rendered light and scoriaceous by the escape of gases, and every gradation can be traced from this condition to the heavy vitreous matter of similar composition known as obsidian.

Most of the volcanoes of Lipari have ejected pumaceous rocks at some period or other; but the best stone is all the product of one mountain, Monte Chirica, (nearly 2,000 feet), with its accessory craters, Monte Pelato and Forgia Vecchia. The mineral is excavated in various parts of the island. To this end, caves or burrows are dug into the layers of denuded lapilli and ashes that have gradually covered the pumice. They occasionally strike the mineral near the surface, at other times a thick mantle of white tuff must first be pierced. Digging in such circumstances affords no difficulties. These caves are lighted at intervals by small terra cotta lamps of antique form, and are so narrow that two men can barely pass. The deficiency of air is soon felt. Sometimes, when a stratum of pumice has been reached, radiating galleries are constructed to gain a larger supply of pumice out of the soft material in which it lies imbedded. The number of caves actually in working has been estimated at 250, but this gives no clew to that of the workmen, as some caves can accommodate only three or four, others as many as fifteen men. Pumice is brought to the surface of the earth in large blocks or in baskets, and is carried thus either direct to the village of Canneto or to the nearest seashore, to be taken there in boats. About one-fourth subsequently reaches Lipari by sea, to be manipulated there. It is generally stored in the sheds of the merchants, and unless these are in a hurry to dispose of their stock it is allowed a month to get thoroughly dry. This reduces the weight and shows off the quality. After that large blocks weighing a stone and upwards are allowed to crumble according to their cleavage into so-called "lisconi," and all the pumice is then sorted according to its size into (1) large ("grosse," lumps down to the size of a fist); (2) medium ("correnti"), and (3) small ("pezzame," from two inches downwards). So extensive are the deposits that the supply is practically inexhaustible. Accidents are rare and generally due to the collapse of a tunnel. Nothing is done in the nature of insurance. A discreditable feature is the employment

of child labor. Owing to the scarcity of inspectors the regulations on this point are apt to be disregarded, and children of both sexes are sent by their parents to work, at absurdly small wages, in collecting "pezzame," or in carrying heavy loads on their shoulders down the long and steep hill to Canneto, under a glaring sun, often twice a day. This is for adults a more continuous and severe strain than the work in the tunnels, and cannot fail to have an injurious effect on the development of young children of five to fourteen years of age.

Arches and Buttresses.

In the construction of these and similar parts of buildings, two desiderata are especially to be kept in view, viz.: Good bonding with the adjoining parts of the structure, and such a disposition of the joints that each stone will take its fair share of the pressure to be borne, while it receives all possible support both from its own form and from its fair bearing upon the subjacent mass. Common arches are of three forms, viz., semi-circular, segmental, and elliptical. Besides these there are the Gothic arches, Tudor arches, three-centered arches, and others, the forms of which belong to architectural art, and the best construction of which can only be determined by practical experience and the knowledge and skill thence required. The radial joints of all arches must be at right angles to the curve of the arch at that point through which the joint passes. The connection of the arch stones or voussoirs depends mainly on their wedge-like shape, which, so long as the central one, or keystone, keeps its place, prevents any one stone from falling out; but if the joints be not truly directed, so as to lie in the line of thrust toward the center of the curve, an oblique pressure is caused against the edges of the arch stones, which, in the course of time, causes them to split off. Arches of which the curve is struck from several centers, the curves being tangential at their points of meeting, are always liable to this injury, which is only mitigated when the joints are arranged so as to coincide with

the lines which pass through the points of contact of the respective arcs which compose the curve of the arch. Elliptical arches are, for a like reason, more liable to fracture at the joints than circular curved arches. The return joints of the arch stone, under the arch, or in the soffit or intrados, as it is termed, are to be worked and fitted with equal care, so that every stone shall abut closely against the adjoining stones throughout the whole of its bearing surfaces. The arch stones must be alternately of large and small depth, so that a bond may be effected in the direction of the axis of the arch. The upper surface of the arch, or extrados, should not, if the thickness of the arch be small, be throughout parallel with the intrados, if other masonry overlies the work, but the arch stones should be allowed, at intervals, to extend upward, and thus connect with the other work. As the theory of the pressure to which arch stones are subject, teaches that this increases toward the lower parts, or haunches, an additional strength is often given to these parts by striking the extrados with a larger radius, thus increasing the height of the arch stones gradually toward the springing points. The impost stones from which the arch at each end springs, being liable to severe pressure and receiving the entire weight borne by the several stones of the arch, are frequently made of harder stone than the rest of the work. Thus granite is sometimes introduced for these stones, while the rest of the work is executed in sandstone and limestone. All the delicate and architectural details of buildings, as entablatures, friezes, enriched cornices, also parts of ornamental columns, pillars, and pilasters, have the joints rubbed carefully after dressing, so as to render them as far as possible invisible when combined in the general design.

Lichen on Stone Buildings.

The green or black covering which forms on light colored stone after some time, has been found by Dr. Fruhling to be a lichen, and if once developed is hard to remove. Its formation, however, may be prevented by painting the stones

with a diluted sulphide of potassium solution at intervals of one year. Leitzmann has attempted to wash off the houses with hydrochloric acid and found that this was effective for three to six years.

Lightning on Washington Monument.

One of the best evidences of the value of lightning rods up to date has been afforded by the Washington monument. It is capped by a small four-sided pyramid of aluminum, which metal, so cheap to-day, was very costly at the time of the building of the greatest obelisk that the world has ever known. This aluminum tip is connected with the ground by four copper rods, which go down deep into the earth. On April 5, 1895, five immense bolts of electricity were seen to flash between the monument and a thunder-cloud overhanging in the course of twenty minutes. In other words, the monument was struck fiercely five times, but it suffered no damage whatever. On June 15, of the same year, a more tremendous assault was made upon the monument from the heavens, and the result was a fracture of one of the topmost stones. The crack still remains to show what nature can do in the way of an electrical shock, but the slightness of the damage is evidence of man's power to protect himself from such attacks. The obelisk is ideally located for attracting electrical assaults from the skies, and yet, while many times hit, it has suffered only once, and that time to a trifling extent.—Boston Transcript.

Indiana Marble.

Wabash, Ind.—John Bradley, who prides himself on being from the wild and woolly West, a resident of Oklahoma, called at the Plain Dealer office and exhibited specimens of mineral. He states that Wabash is a mining town, that lead, zinc, gold and other valuable minerals are to be found near the place. Mr. Bradley had a lot of specimens. One was a stone taken from a vein of lead ore, and there were also fine specimens of marble. Mr. Bradley took a small piece of marble

to the granite and marble establishment of Thorne & Wilson and had it polished. The specimen was from the surface. It dressed up very nicely, and Mr. Thorne believes that further back very good marble may be found. The specimen Mr. Bradley claims was quarried near Wabash.

Legal Decisions.

Provision for decision by architect.—A building contract with a city provided that, if the building should not be completed in five hundred working days the architect should certify what portion of the delay was chargeable to the contractor, and such certificate when approved by the Commissioner of Public Works should be final. Another clause stipulated that whenever in the opinion of the architect the contractor had performed his contract, the architect should so certify to the commissioner, whereupon the city should, after thirty days, pay the amount due under the contract. The court held that the commissioner was merely to determine the extent of the delays caused by the city, while the decision respecting other delays was to be made by the architect, whose certificate was conclusive.—Lantry vs. New York City, 44 N. Y. Supp. Rep.

What is not an "Extra."—A building contract provided that the contractor should make the excavations and put in the stone foundations of the proposed buildings according to the plans and specifications, including all labor and material necessary thereto. In order to make the excavations it was necessary to underpin a building on the adjoining ground, and to use a quantity of lumber to do this. The court held that the underpinning of the house and the lumber used in the trenches were included in the terms of the contract, and that a recovery for same could not be had on an implied obligation to pay what they were reasonably worth.—Ashley vs. Henahan, Sup. Ct. Ohio, 47 Northeastern Rep. 575.

No lien for damages.—In the case of a building contract, where the owner has wrongfully interrupted the contractor and prevented his completing the work,

the contractor is entitled to a lien for the reasonable value of the work already done and the material furnished, but he cannot have a lien for the damages he has sustained by reason of the breach of contract by the owner.—Pardde vs. Missouri Pacific Railway Co., Sup. Ct. Neb., 71 Northwestern Rep., 235.

Rejection must be at time of inspection.—Under a contract providing that a builder is to make a job to the "satisfaction" of the owner, who has power to reject all work and materials not the best of the kind specified, and that the work is to be inspected as it goes on, and accepted by the owner before final settlement, such owner waives all defects in work and materials not rejected at the time of such inspection and during the progress of the work.—Laycock vs. Moon, Sup. Ct. Wis., 72 N. W. Rep., 372.

Openings in South Africa.

I have the honor to submit certain information for the benefit of the manufacturers of the United States:

BICYCLES.

The Chartered Company of Rhodesia are contemplating the formation of a bicycle corps.

ELECTRICAL MACHINERY.

East London seeks tenders for electric lighting and street-car system.

Durbin desires estimates for an electric street railway.

Delagoa Bay is contemplating the lighting of the bay by electricity.

The harbor board of Cape Town talk of using movable electric cranes, consisting of engine, cranes, and locomotives.

GAS.

Cape Town is discussing the advisability of using automatic gas meters.

England has been receiving orders from South Africa for agricultural machinery, blowers, cranes, bicycles, electrical plants, engines, flour-mill machinery, pumping machinery, furniture, rifles, mining machinery, railway material, telegraph and telephone material, road rollers, tile and pipe making plants, water drills, etc.

There has been a considerable falling off in the value of goods shipped to Natal

during the first quarter of 1898 from all the principal exporting countries.

J. G. STOWE,
Consul General.

Cape Town, July 25, 1898.

in 1897 amounted to nearly 2,000,000 tons, and the value of the freight receipts aggregated \$2,801,970.

JOHN A. BARNES, Consul.

Cologne, August 17, 1898.

American Commission Houses in Germany.

There is a movement on foot to incorporate a company under the laws of Germany, which will be prepared to erect suitable buildings for the display and sale of American products, providing manufacturers and dealers in America show a disposition to aid and encourage such an enterprise. This proposed company will construct buildings as desired by special interests, at an agreed rental, and will also be prepared to contract with the owners of merchandise to handle and sell their goods upon commission, and guarantee the payment of all bills of goods sold by them or their agents.

Germany appreciates our standing as a nation, and, I believe, would be willing to meet us half way in a fair exchange of commodities. Would it not be well for a number of our manufacturers to send over a representative to make a thorough investigation of the field with a view to making arrangements with parties here for the housing and handling of their various products?

The city of Cologne, from its favorable location, would make an excellent distributing point for all kinds of merchandise. It is a city of nearly 350,000 people, with railway and steamship facilities unexcelled in Europe. Docks and wharves of solid masonry extend for miles along the river banks. There are four railroad depots, the central station being one of the finest in the world, built and equipped at a cost of about \$8,500,000. The chief custom house of the province is also located here. During the year 1897 there arrived at the harbor of Cologne 5,869 steamers, tow boats, and sailing vessels, carrying a total of 558,533 tons. There were shipped from this harbor during the same time 209,766 tons, in 4,765 vessels of all kinds. I am informed that the amount of goods and other merchandise received and shipped by railway

Cost of Terra Cotta and Stone.

At one time terra cotta had decidedly the call on stone as to cost. Almost always terra cotta was the cheaper. Recently bids were opened in this city on a building where both stone and terra cotta were figured. The result was largely in favor of the stone. There were too good reasons for this. In the first place, large numbers of quarries have been developed, and experience of dull times not only has led to economy in quarry methods, but has habituated quarrymen to lower prices. Furthermore, competition has developed stone-cutting machinery so that when it comes to plain molded or turned work, or when a great variety of patterns is used, stone is a dangerous competitor in this section. In a tall office building recently let, in which there was quite a large amount of decorative work, the stone and terra cotta bids ran about the same. This was owing to the fact that all of the molded work and some of the decorative work could be cut on the lathe.—The Clayworker.

Concrete Aggregates.

The use of concrete for every kind of construction has become so general that the quality of the materials of which it is made is a matter of great importance. Specifications prepared for this purpose invariably call for broken stone, to the exclusion of other materials. I find that many persons, who have not given the subject proper consideration, contend that the compound is complete whereby stone, regardless of its quality or texture, enters into the mass. I will here state that as much care should be taken in the selection of the aggregates, stone and sand, as in that of cement. The stone should be perfectly clean and free from flour and dust. The fragments should possess angular faces and be graduated as to size. The theory that limestones

contribute to the strength of the mortar with which they are mixed, and ultimately produce stronger concretes, is incorrect. The limestone will invariably produce a concrete that can be termed as tough, but never attains extreme hardness, which is essential in all constructive work. I have also found that concretes prepared from limestone aggregates are much more liable to expansion than other stones. The irregular faces and sharp edges of broken stone are not all the advantages in the composition of concrete. It is essential that the aggregates should vary in size, so as to form a wedge with each other, and thereby permit of being properly compacted by ramming. Care should be taken to exclude long, thin fragments, which invariably crush under pressure, or break in ramming the mass. The best concrete is obtained by using at least two sizes of broken stone, smaller than the largest aggregate. This fact can be readily demonstrated by mixing the stone and placing it in a heap, when the resistance to ramming will be apparent. The use of one size stone is liable to produce arching, even when the presumption is that the concrete has been properly rammed. When preparing concrete I have frequently used screened gravel with equal parts of broken stone. I have found its oval surfaces pack more closely in the interstices of the stone. To sum up the matter, a variety of shapes and sizes in the aggregates are essential for the ultimate strength of concrete.

I would therefore recommend that a percentage of the stone aggregates used in concrete be proportioned into at least two sizes, under the largest aggregate.—Warner H. Jenkins, C. E., in *Municipal Engineering*.

Photography on Marble.

For photographic printing on marble, coat an unpolished slab of marble with a solution of benzine 500 parts, spirits of turpentine 500 parts, asphaltum 50 parts, pure wax 5 parts. When dry expose under a negative. The printing will take, in sunshine, about twenty minutes. Develop with spirits of turpentine or benzine and wash in plenty of water. Cover

the plate where it is intended to be left white with an alcoholic solution of shellac and immerse in a dye which is soluble in water. After awhile, when enough of the coloring matter has entered the pores of the stone, it is taken out and polished. The effect is exceedingly pretty.

Tests of Stone for Road-Making.

The experimental work of testing road-building stone, which has been carried on at Harvard University under the supervision of L. W. Page, a geologist, is described in the report of the highway commissioners of Massachusetts. The commission is composed of T. C. Mendenhall, W. E. McClintock and C. W. Ross. In making these inquiries the aim has been to determine the nature of the qualities which constitute fitness or unfitness of the different kinds of rocks for use in road-making, the effects of diverse methods of treatment used in the process of construction, and the relative value of the bed rocks and gravels which are found in the several parts of the state. The abrasion and the cementation tests have proved most useful thus far. The machine used in conducting these tests was designed by William Page, under the direction of the commission. The abrasion machine was modeled after the Deval machine, such as is used in making similar tests at the national school of roads and bridges of France. In making the abrasion tests with the Deval machine the stones employed are of such sizes as will pass through a screen with a $2\frac{1}{2}$ -inch mesh and not through a screen with a $\frac{1}{2}$ -inch mesh. In making the test eleven pounds of stone, previously cleaned, are placed in the cylinder; the air-tight cover is then screwed on and the cylinder rotated at the rate of two thousand revolutions an hour. The rotation of the cylinder throws the fragments of stone from one end of the cylinder to the other twice in each revolution. At the end of five hours, or ten thousand revolutions, the machine is stopped, the cylinder opened, and the contents emptied into a basin. The cylinder and cover are carefully

washed and the water used is poured into a basin. Each stone is then washed and brushed under the water, and is thus cleaned from the adhering dust, which remains in the water as a sediment. After it is dry the detritus is emptied into an automatic sieve which separates that below one-sixteenth of an inch from that above. The per cent. of the $\frac{1}{16}$ -inch dust may be taken as a coefficient of wear, or the coefficient adopted by the French school of roads and bridges may be adopted by the formula—

$$\text{Coefficient of wear} = \frac{40}{w}$$

where w is the weight in grammes of the detritus, less than one-sixteenth of an inch in diameter obtained per kilogramme of stone.

The tests on all specimens are made under precisely similar conditions, so that all results are comparable. The tests on the more common rocks show the following results:

Kind of stone.	Highest result.		Lowest result.	
	Coeff. of wear *	Per cent. of wear.	Coeff. of wear.*	Per cent. of wear.
Diabase (trap).....	30.40	1.31	9.28	4.31
Granite.....	21.16	1.90	8.41	4.76
Felsite.....	19.01	2.01	12.30	3.25
Gneiss.....	23.02	1.73	5.01	7.98
Limestone.....	17.30	2.33	6.31	6.34
Schist.....	12.52	3.19	4.87	8.20
Quartzite.....	20.34	1.97	9.07	4.41
Field stone (erratics).....	19.19	2.08	5.43	7.30

*On the French system.

For testing the cementing value of stone, a machine consisting of a 2.2-pound hammer arranged like the hammer of a pile driver on two vertical guides, is used. The hammer works automatically and can be dropped any desired height upon a plunger under which the briquette to be tested is placed. The plunger is held in two guides and attached to it is a lever, pivoted at one sixth of its length from the plunger and carrying a pencil at its free end. The pencil has a vertical parallel movement five times as great as that of the plunger, and its movement is registered on a drum against which the pencil presses. The drum rotates through a small angle at each stroke of the hammer; thus an automatic diagram is taken of the behavior of the briquette throughout the whole test. The point brought

out by this machine is the fact that, when the hammer falls on the plunger, if the material beneath it can stand the blow, the plunger recovers from the downward thrust given it by the hammer; if not, the plunger stops at the point to which it is driven. In this way the number of blows previous to the critical blow, which destroys the bond of cementation, are accurately recorded on the drum.

The briquettes for the cementation test are made by reducing the stone to a dust that will pass through a sieve of $\frac{1}{100}$ of an inch mesh. The powder is put into a slightly tapered steel die of circular section, about 1.33 inches in diameter, and .98 inches in height, mixed with water and subjected to a pressure of 4,400 pounds. The briquette resulting from this is put aside for at least one week, in order to become thoroughly dry.

Municipal and Contract Systems of Stone Crushing Compared.

Several months ago we referred to the action of the municipal authorities of Bridgeport, Conn., in putting in a plant for crushing stone for the alleged reason that it could secure the material from 40 to 50 per cent. cheaper than under the contract system. On account of this decision one of the largest industries of the city—the B. D. Pierce Crushed Stone Co., which had for years furnished the city's supply of crushed stone—were compelled to remove its plant to another city.

The first report of the committee in charge of the operations of the city's plant is as follows:

The crushing plant has been completed at a total cost of \$3,697.18 and has been in operation since July 15.

In addition we have expended \$131.63 for quarry tools, hose, ladders, etc., \$52.69 for repairs to steam drill, making a total of \$3,881.50.

We would explain that the excess of expenditures over the sum of \$2,000 appropriated, consists mainly in the extra costs of bins. We originally contemplated building 70-ton bins, at an expense of about \$300. We decided later that it would be to the best interest of the city to build bins that would hold 100 tons or more, and also buildings for engine, boiler and crusher, and roof for bins, thus protecting the entire outfit from damage by storm, rain or snow.

We also expended about \$10 for pipes and labor in getting water for boilers from a stream on the east side of Park avenue.

From June 17 to July 15, we expended \$1,112.29 for labor of opening quarry, building roads, etc., producing previous to July 15 only eighty-eight tons of crushed stone. Of this amount we estimate that the stone quarried during that time was worth \$400 to \$500, and that the balance, \$700 or \$600, to be the cost of opening quarry and making roads. We intend, however, to include all such expense as a part of the cost of the stone, and include it in our statement at end of season.

From July 15 to September 3 we produced 4,206 net tons at the following cost:

Pay rolls for labor.....	\$1,940.38
Sharpening tools.....	72.00
Coal.....	95.25
Dynamite and fuse.....	49.40
Oil.....	70.37
Sundries.....	7.25
Total.....	\$2,234.65
Add royalty at 6 cents per gross ton.....	225.30

Net cost of 4,206 tons.....\$2,459.95

Showing an average cost of 58½ cents per ton.

This average cost is for seven weeks' work and covers all the time since the crusher began work. The stone quarried and crushed during the past three weeks has cost about 50 cents per ton, and with cooler weather we expect to increase the output and continue to further reduce cost. We feel assured that at the end of the season we can show that we have paid all cost of opening quarry, etc., and have produced stone at less than the price originally estimated—60 cents per ton—and that our city will be able to secure stone next year at 50 cents per ton, quarried by laborers who are citizens, at city wages, working nine hours per day.

On this the Bridgeport Union comments as follows:

The report submitted to the board of aldermen by the committee who have the city quarry and crusher in charge is misleading. This interesting document carries the idea that the city is getting its street material cheaper than under the contract system. While the statements in the report are not actually falsehoods they are framed to deceive the public, in that it fails to state the amount of screenings which is being bought daily for use on the streets. Almost every day the street commissioner receives two carloads of fine stone which costs the city enough to bring the average way above the


price computed by the committee. The screenings furnished the city (when the attempt was made to fulfill the promises of the mayor and furnish all the stone needed) were anywhere between 60 and 75 per cent. ordinary dirt which was weighed in as screenings and dumped on the streets. Then again, all the stone furnished from the crusher since the first week elapsed has been more than one inch in diameter which is called for by the ordinance. It requires much less time to crush the large sizes, and any contractor would be glad to furnish the sizes which have been used at 50 cents per ton. There was a direct violation of the ordinance on every job the city has done with the stone from the new quarry. The crusher and appurtenances which was to have cost only \$2,800 has already cost the city \$3,800, or \$1,000 more than the original estimate, with many bills yet to come in. The proposition has not been fairly stated in the report, and the members who compiled it have been evidently making a deliberate attempt to make the crusher's showing much better than it really is.

Tomb of Tamerlane.

Samarcand is richer in historical monuments than Bokhara in Asia, but nothing dates farther back than the fourteenth century. Hardly a trace of its greatness remains, except of the great Timur (or Tamerlane) of that period. He alone has left monuments, mostly of personal character, of his great reign five hundred years ago. Samarcand is 2,150 feet over sea level, and might be a veritable health resort for Asia. As elsewhere, the monuments do not keep well. The recent earthquake has left its mark, and in a few years there will hardly be anything left for antiquarian interest in Samarcand. It is all very well for irresponsible writers to decry the Russian authorities and say they have no care for the historic buildings, of which they now are the guardians, but it needs only the casual glance to assure one's self that these buildings are practically past restoration or repair. Blue turquoise is the color of this part of the world, its keynote, and generally in architecture predominating in various tints. But the glaze is often only veneer.

SELECTED MISCELLANY.

UN-CIVIL WAR.

 **T**'OTHER night, at Bingham's store,
All us fellers, somehow, got
Arguin' about the war,
An' we had it purty hot.
Silas Lupin, he made out
That them volunteers must be
Pesky foolheads, jest about,
To go off and fight, and he
Sez, "Wall, let 'em go ahead,
"I'll stay home, by gum, instead."

Then Ned Bingham said he thought
That the war was right enough;
"Ya-as!" sez Sile, an' so yer ought,—
See the prices on yer stuff!
*You're a-layin' up yer pile,
You're a-saltin' down the rocks,"*—
So he sputtered, all the while
Eatin' raisins from the box;
"Don't git rich," sez Ned, "I vow!
On my raisins, anyhow."

Sile, he never stopped a bit,
Called the war a wicked sin,
"Folks was fools that bled and fit,"—
Then his wife come marchin' in.
Judas! how she shet him up!
Never let him say a word,
Called him "shifless, idle pup,"
All the names yer ever heard,
Sez, "Go home, yer lazy gump!"
An' he done it, on the jump.

"Boys," sez Reuben Pettigrew,
When the two was out of sight,
"Guess it's plain ter me an' you
Why Sile wouldn't go ter fight,
If it's war he's lookin' fer,
Ain't no need fer him to roam,
Long's he tries ter live with her,
He'll have war enough at home;
Ain't no Spaniard that 'ud dare
Face that woman anywhere."
—Joe Lincoln, in L. A. W. Bulletin.

Light Railways.

In the construction of light railways the difficulty is to strike the happy medium. The solidity of an ordinary trunk line means, in most cases, more expense than a light railway can bear. On the other hand, care must be

taken not to construct works too flimsy and meager in character.

A careful estimate should be made of the requirements of the district and full allowance made for the future development of traffic, and it will be found to be ultimately much cheaper to fully cater for these possible requirements at the outset than to make too small a provision at the beginning and be continually making additions at enhanced expense as the traffic grows, and when land has increased in value.

The permanent way and structures, therefore, should be sufficiently solid and substantial to stand the heaviest traffic which is likely to be placed upon it, and sufficient stations, sidings, cross-over roads, good sheds and engine sheds should be provided to give every facility for the encouragement of traffic and to secure a monopoly in the district.

In some cases a track may run alongside a public road, in which case a continuous barrier may be necessary; but it may be better in many cases to make a new road for the railway, as many public roads are quite unsuitable for this purpose, being sometimes merely developments of pathways, and more or less winding and undulating. A more direct and level route could probably be taken with little additional trouble and without any considerable increase in the outlay.

It will be most desirable to make the gauge the standard one of the country in which the railway is to be run, as although a narrow-gauge line, say, three feet, could be built for perhaps 35 per cent. less than a four-foot 8½-inch line, the avoidance of the delays and extra labor and plant involved in transfer of goods, and the ability to intercommunicate with the surrounding standard gauge lines, would, in the long run, more than compensate for the increased initial cost.

Where the speed will not exceed twenty-five miles an hour, and, especially where the line is

to be worked by only one locomotive, the railway company may dispense with many of the ordinary requirements, such as gate watchmen, signals and telegraph, and fencing need be erected only at dangerous places, and thus a considerable saving in the outlay may be made.

Where the speed is to be twenty-five miles an hour, and the locomotive weighs about thirty tons, 45-pound rails would be found sufficient, with sleepers measuring, say, $6' \times 7\frac{1}{2}'' \times 4\frac{1}{2}''$, fixed about 1,900 to the mile, and the ballast under the sleepers 4". Where the maximum rate of speed is to be lower than twenty-five miles an hour, the rolling stock and permanent way may be somewhat lighter. In practice it has been found that fifteen miles an hour is the maximum speed consistent with cheap maintenance on light lines.—C. E. Spagnoletti, in *Cassier's Magazine* for October.

Tombstones and Coffins Made of Glass.

A Pennsylvania inventor makes the rather startling proposition of introducing porcelain tombstones; but upon reflection this appears more radical than impractical. If you have ever visited any of the old burial grounds, dating from the seventeen hundreds, you must have been struck with the perishable nature of the ubiquitous white marble. There is hardly a single specimen of such a tombstone, the inscription of which is legible after one hundred years of exposure to the elements.

The Swedes introduced slate tombstones and these, while not so striking when new, have proved themselves the best fitted for this particular use, as many of these may be found today in New England cemeteries, dating back to the early years of the past century, that are quite as readable as the day they were erected.

Porcelain can be handled on a large scale nowadays, an instance of which is the house now building for the Japanese exhibit at Paris in 1900. This house will be hexagonal in shape, each side measuring several yards, and composed entirely of porcelain.

The suggestion above referred to of using porcelain for tombstones, which, by the way, has been patented, contemplates a facing of porcelain built around a body of concrete to give stability and strength and decrease the cost. The inscription would be in bas-relief and attached to the headstone much in the manner that handles are attached to cups and dishes.

Another mortuary proposition of the same tender is that of a Pittsburg firm, which proposes to manufacture glass coffins, which are to be hermetically sealed. These, of course, will be much more durable than any wooden, or even metallic, casket, and would preserve the body from that contact with the earth that ultimately follows the disintegration of the wooden coffin.

The function of a tombstone is to mark the place of burial and to carry the customary inscription of name and date of birth and death. Viewed in this light the suggestion to use porcelain tombstones is a very practical one, as the elements would have little or no effect on a glazed porcelain surface. If the framework were built up on a metallic sheeting there would be but little danger in breaking, and the porcelain could be made of much greater strength than is possible with requirements of kitchen ware.—*Duluth Tribune*.

England's Cathedrals.

The external beauties of Canterbury can best be seen from a distance. The old town nestles under its walls, and beyond is a ring of hills encircling the city, from which you look down the rich, peaceful valley of the Stour, where cattle stand knee deep in clover, and see the mighty church towering over the red-tiled roofs of the houses, the mother building of English-speaking men's religious life.

The cathedral is constructed in the form of a cross, 540 feet long by 156 feet in breadth. There are several enriched entrances of various dates, distinguished for beauty and plenitude of ornament. The western front is the work of Friar Chillenden, a skillful architect of the reign of Richard II. The nave consists of a series of clustered columns on each side, from which rise the light and graceful arches peculiar to the Pointed style. Trinity Chapel, situated to the east of the choir, contains the most authentic memorial now remaining of the first of a long line of English heroes—the tomb of the Black Prince. So dearly was he loved that he was allowed a resting-place in the most sacred spot of that time. His effigy is of brass, and one can trace the resemblance in the features with the effigy of his father and his grandfather, the one in Westminster Abbey, the latter in Gloucester Cathedral.

Salisbury is unique for two reasons: First, it has the clearest record of its history. In almost

every other church there are vague legendary accounts of the original foundation, but here the antiquarian may find a trustworthy chronicle of its first inception and each successive stage of its progress. Second, it is the most notable specimen of early English extant, and also the first important building carried out in that style. The chief reason for its extraordinary purity and harmony is that it was begun and finished within forty years (1220-60). The spire is 406 feet in height and is the loftiest in England. The cost of the building was equivalent to \$2,500,000 in the money of our day. And Henry III. is supposed to have been so enthusiastic in his admiration of Bishop Poore's new church that he at once revolutionized the plans for Westminster Abbey and completed the London church after his example. It has been called "the Parthenon of Gothic architecture." Pugin declared he had seen nothing like it in Europe, and perhaps Amiens in France is its only serious rival.—"The Cathedrals of England," by S. Parkes Cadman, in the *Chau-tauquan* for October.

Symmes's Hole.

I was sitting in the smoking room of the hotel one afternoon. I was not quite alone, for on the opposite side of the room, reclining in a rocking-chair, was a small, sharp-featured man, who was smoking cigarettes. His eyes were fixed on the ceiling, and he was drumming on the arms of his chair with the fingers of both hands. Suddenly he turned and said to me:

"Great thing, electricity! The day is coming, sir, when we shall do everything by electricity."

I replied that he was probably right, for it was obviously necessary for me to say something.

The man got up, and crossing the room, sat down in a chair quite close to me, and leaned forward as if to make a confidential communication.

"People think that the electric light is a great invention," he remarked. "So it is, but there have been greater inventions that nobody knows anything about."

"Indeed?" I said coldly, for I was not anxious to be talked to death, and I feared that I had met a man who was entirely capable of committing such a crime.

"I like your looks, sir," continued the man, "and I'm going to tell you about one of the

biggest electrical inventions that has ever been made, or that ever will be made. I'm going to tell you about my electric drill, which I invented three years ago. I can promise you that it will interest you some, and astonish you considerably. However, I don't want to intrude, and if you'd prefer to have me shut up, all you've got to do is to say so."

I am weakly good-tempered, and I sadly resigned myself to the coming infliction, saying to the man: "Go on! I shall be very glad to hear about it."

"Three years ago," he went on, "I was living in Wisconsin, in a farm house that my father had left me, with no neighbors within two miles. I had been educated for an electrician, and had invented two or three little things that weren't calculated to attract much attention, but were mighty useful in the electric installation business. I had considerable money at the time, and I used to spend most of my time working in a laboratory that I had fitted up in the farmhouse.

"What I was working at especially was an electric drill. Drilling an artesian well, or an oil well, or anything of that sort, is a slow business, and fully half the time is occupied in scooping out dirt that is made by the drill. My idea was to make a drill to be operated by electricity, that would just burn its way down into the earth. You can burn anything provided you can get heat enough, and you can get any amount of heat you may want out of electricity, provided you know how to do it. I wanted to make a drill that would be so hot that it would just sink down into the earth, consuming everything in its way, just as a hot needle sinks into a piece of wax.

"Well! I don't want to trouble you with all the details of the thing. So I will just say that I invented the drill, and proved to my satisfaction that it would do everything I wanted it to do. It didn't look much like a drill, for there was no sharp-pointed cutting tool about it. There were just two stout insulated wires, that terminated in a sort of disk that was heated by the electric current hotter than anything was ever heated before on the earth. I had, of course, a dynamo to furnish the electricity, and a donkey-engine to drive it, and also to wind a reel on which the wires were coiled, so that I could lower the disk as it made its way into the earth, and could pull it up again in case I should want to do so.

"I started to drill my hole in the yard back

of my house, where what I was doing wouldn't be noticed by any one who might pass along the road. For that matter there wasn't very much to be seen; nothing but a small derrick, over which the wires ran, and which stood directly over the place where I was boring. Where I lived you can strike granite rock almost anywhere by digging from one to three feet. I cleared away the earth till I reached the granite, and then I started my drill. Sir! as sure as I'm sitting here, that drill sank into granite as easy as a knife would sink into butter on a hot day. There was no noise about it, nothing except the humming of the dynamo. The drill made a clean hole of four inches in diameter, out of which a thin column of smoke went up. In ten minutes' time that drill had sunk a hundred feet below the surface, and I saw that I had made the biggest success that an inventor could dream of making. I had started the thing with a thousand feet of wire attached to the drill. It was clear enough that a thousand feet would not last many hours. In fact, it had all been used up long before the morning was over. So I shut off the electricity, and leaving my drill nearly a thousand feet below the surface, I drove into town after a new lot of wire. This time I brought back with me ten thousand feet of steel wire, and ordered two miles more of it to be sent to me at once. I attached my ten thousand feet to the drill, and set it to work again. Everything went as smoothly as possible. There wasn't the slightest hitch in the drilling apparatus, the engine, or the dynamo. The drill went at a perfectly regular rate, showing that whatever sort of rock or earth met it was all one to it. The only thing that surprised me was that it didn't appear to meet with water. That is to say, it didn't strike any stream powerful enough to interfere with its action; though now and then I could see that steam was coming out of the hole as well as smoke.

"How deep did I calculate to go? Well! I hadn't any definite notion. My idea was to keep the drill going as long as my supply of wire. I wanted to find out what there was deep down in the earth. Most folks say that the interior of the earth is melted rocks and such, but I never took much stock in that story. Anyway, I had a fair chance of finding out the truth of it, for so long as my drill kept sinking at a uniform rate, it meant that it was working its way through solid matter, and in case it should stop working, that might mean that it

had reached the central fire and been melted, or had nothing more to work on. Of course, I calculated to draw the drill up to the surface and examine it if anything should seem to be going wrong, but I was pretty well convinced that I could drill clean through to Chin, provided my supply of wire should hold out.

"I kept the drill going night and day, for the only superintending it needed was the feeding of the donkey-engine. In the daytime I used to sit in a chair alongside of the drill and watch the wires descending into the ground, and the smoke curling up out of the hole. All of a sudden the wires stopped. First there was a dead stop. Then I could see a sort of trembling movement in the wires, and then another dead stop. I cut off the electricity, and stopped the engine. The register showed that a mile and a third of wire had been run out, which, of course, gave the depth of the hole. I began to think that I had struck the central fire after all, but then I noticed that there was no more smoke coming out of the hole, which did not look much as if the drill had reached anything that was hotter than itself. I reversed the engine, and started to wind up the wire, and bring the drill to the surface.

"It was slow work, but the inside of the hole was so smooth and true that there was nothing to prevent the drill from being drawn out. I kept the engine steadily at work, and finally it had gathered in all the wire, and I was looking to see the drill reach the surface, when out came the two ends of the wires, with never the trace of the disk. I stopped the engine and examined the wires to see whether the disk had been burned off, or had simply been lost in some other way. What I found was, that the wires had been cut clean across with some sharp instrument, and when I saw that I sat down on the ground, feeling as faint as if I had been hit over the head with a club.

"You see yourself what the cutting of the wires meant. Wires can't be cut by a sharp instrument unless somebody holds the instrument, or directs the machinery to which it is attached. Down a mile and a third in the bowels of the earth somebody had seized my disk and cut the wires which held it. There was no getting away from that conclusion. You may say that what I took to be a cut made by an instrument might possibly have been a bite made by the teeth of some animal; but it was as easy to suppose that there were men at that depth below the surface as to suppose that

there were animals that fed on steel wire. Besides, if animals could live there, why, it followed that men could live there too. Did ever you happen to hear of Symmes's Hole? Well! Captain Symmes was a fellow-countryman of mine, and he wrote a book to prove that the inside of the earth is hollow, and is inhabited by men; and that there is a hole at each pole which communicates with the place where these men live. Everybody laughed at Symmes's Hole, and the poor man died broken-hearted, and people have pretty near forgot all about him. But I know now that Symmes was right, for it was nothing more or less than Symme's identical hole that my drill had dropped into.

"I put my ear to the mouth of the hole I had drilled, but though I fancied I could hear a dull sort of heavy sound, as if there were a lot of heavy traffic, or an enthusiastic political meeting going on below, I couldn't really say that I could hear anything of consequence. Having made up my mind that there were people below that had caught hold of the idea that I was at the other end of the wires, I went to work to open communication with them. I got a bottle of whiskey that I had in the house, and first-class whiskey it was, too; the sort of thing that would prove to anybody who opened it that it came from a gentleman, and a man of culture—and I tied the bottle, together with my card, to the end of one of the wires, and lowered it into the hole. I said to myself, that when the people in Symmes's Hole should get hold of that whiskey they would say to themselves that the man who sent it was worth knowing, and would send back a line of thanks, and a request for further acquaintance.

"When the bottle reached Symmes's Hole the wire stopped running out; then it trembled a little, just as it had done at first, and then it hung quiet again. Judging that everything was all right below, I started the engine to haul up the wire, and I was mighty anxious to see the end of it, and to find out what the folks down in the bowels of the earth had to say to first-class whiskey. It seemed to be years before the wire was all reeled in. Then I saw the bottle was gone, and in place of it was a square bit of metal something like bronze, though it was not the kind of bronze that we have here. There was a message of some kind written on the bit of metal, though I couldn't make head or tail of it, not knowing the letters, let alone the words. Here is the thing, if you'd like to

see it. That is, I supposed it was here, for as a general rule I carry it in my pocketbook, but I see that I have left it up in my room. I don't suppose there is a more interesting curiosity in any museum than that piece of metal. I showed it to a scientific man in Chicago, and I calculated that he'd say it was worth its weight in diamonds; but scientific men are a jealous lot, and never think much of anything that they haven't done themselves."

"What did this scientific man say about the piece of metal?" I interrupted.

"He said that I had better see a doctor, and that he hadn't time to spend in looking at scraps of tin. I told you he was jealous. They all are, and that's the reason why I never showed the thing to any other scientific man. Though I couldn't read the message that had been sent to me, I know well enough what it must be. Just put yourself in place of the people that had received that bottle of whiskey, falling, as you might say, from the heavens. What would they naturally do? Why, they'd sample the bottle, and then they'd write a note, expressing their thanks, and asking for more. When I had studied the thing out, and had come to the conclusion that this was what was written on the piece of metal, I felt that it would be only polite to comply with the request, so I got another bottle of the same brand, and sent it with my compliments tied onto the neck of it, down into Symmes's Hole. It went down all right, but it afterward appeared that there was a misunderstanding about the affair.

"I let down the second bottle, as I was saying, and in due time I pulled up the wire again. Just as the end of it reached the surface, my cat, who was an inquisitive sort of beast, as most cats are for that matter, went up to the hole and put his nose into it, with a view to finding out if it held out any hopes of mice. Just at that minute something came up that hole and hit that cat on the head, and that was the end of the poor beast.

"Whatever it was, and so far as I could find out, it wasn't a bullet or anything of that kind, it killed the cat as dead as a door-nail, and there isn't the least doubt that it was meant to kill me. That taught me two things. One was that the people in Symmes's Hole hadn't any manners, or any gratitude; and the other that the neighborhood of the hole I had made wasn't particularly safe. I hate to slander folk that I have never seen, and especially to slander

them behind their backs; but I can't help believing that the Symmes's Hole people are no better than so many fanatics. Instead of appreciating good whiskey—and the whiskey I sent them was something that they had never tasted before, and will never taste again—they appear to have got mad, and tried to kill me by sending some sort of deadly vapor up to the surface. If I had been at the mouth of the hole instead of the cat, I shouldn't be here at this identical moment, but should have been a victim to ingratitude and fanaticism. I had hoped that the people down below would prove to be some superior kind of beings, something in the line of underground angels, you understand; but I was satisfied when I saw my dead cat that they weren't the sort of folks that I wanted to make friends with.

"I got a couple of buckets full of dirty water and poured it into the hole, just as a sort of hint that I wasn't the sort of man to be insulted with impunity. Then I drove a big wooden plug into the hole, and covered it over with earth and sod, so that nobody would find it. When the job was finished I went into my house, and sat down to write out a full account of the whole affair, intending to send it to some big society, and make a first-class reputation as a discoverer. But that night I was taken with a sort of fever, and kept my bed for I don't know how long. When I was well enough to walk around again, the doctor and all my friends said I must travel for my health, but I can't see as I have got any good by coming away. I have a headache pretty near all the time, and having to be continually on my guard against people that want to poison me, I don't get my rest as I should get it."

At that moment a gentleman entered the room. He evidently was quite unconscious of the existence of the discoverer of Symmes's Hole, but the latter turned pale when he saw him, and hurriedly whispering to me, "There's one of them," left the room. As I afterward ascertained, he left the hotel that night, and I

have never seen or heard of him since.—W. L. Alden, in *Nickell Magazine*.

Trade and the Flag.

The maxim that trade follows the flag covers more error than truth. It is oftener the case that the flag follows trade. But, if foreign nations are going to exclude us from trade with China and Africa on the same terms as their own subjects, we have got to make a way for trade by sending the flag with its usual accompaniments of breech-loaders. If the United States and England would not be driven out of Chinese trade by the gradual extension of Russian and French frontiers, they will have to keep the door open by inserting the muzzle of a cannon into it. England has got her cannon mounted at Weihaiwei and Hong Kong; Manila is not so near as would be desirable, but it will do very well as a place for our guns.

So the more commerce is extended the more danger there is of war. Probably the United States and England would never make war upon each other for commercial reasons, in spite of the radical differences in the economic politics of the two nations. But there are nations in a more backward stage of civilization and economic development which confess their inability to do business under the policy of the "open door"; they admit that on account of their inferiority they can extend their trade abroad only by armed seizure of foreign territory, excluding other nations, or admitting them to the privilege of shooting on their preserves only by charging them roundly under the forms of a discriminating tariff. These other nations appear to be willing to fight in order to keep competitors away. Therefore the nations that are willing to enter a peaceful struggle for commercial success find that they must be equally willing to fight, or withdraw from the contest altogether.—Fred Perry Powers, in *October Lippincott's*.

The Genesis of Street Mud.

Mud on the streets of city, town, or village is a subject of perennial controversy. To resolve the painful question "Whence all this mud?" the Western Mail, Cardiff, Wales, has taken the practical step of obtaining cubes of various specimens of macadam in common use, and submitting them to tests by percussive attrition and absorption as well as ordin-

of basalt specimens stood a respective average maximum stress per square inch of 9.35, 12.02, and 12.45 tons; the other basalts bore 5.54 and 9.45 tons respectively; the Clew Hill, Wicklow, and Guernsey granites went up to 5.49, 6.41, and 7.99 tons; the Mumbles limestone to 5.96; and the other two limestones to 3.99 and 3.09 tons. The real mud test, of course, was that by percussive attrition, the specimens being separately sub-

REPORT ON PERCUSSIVE-ATTRITION TESTS.

Material.	Dust or Dry Mud produced in four hours' test per cent.	Average Compressive Strength: Tons per square inch.
Basalt C.....	3.2	12.45
Basalt A.....	5.0	1.35
Basalt B.....	6.5	12.02
Clew Hill Granite.....	7.0	5.49
Penlee Stone.....	7.2	5.54
Clew Hill Dhu Stone.....	7.9	9.45
Wicklow Granite.....	8.0	6.41
Guernsey Granite.....	9.3	7.99
Aberdeen Granite.....	15.7	—
Red Brick (hard).....	16.9	—
Black Limestone, Mumbles.....	20.0	5.96
Cornish Granite.....	22.1	—
Road Metal from Cardiff Gaol Store (Castell Coch).....	22.5	—
*Road Metal from Cardiff Gaol Store (Ely).....	26.4	—
Sweldon Stone.....	30.2	3.99
Cwymnogydd, Tongwynlais.....	34.7	3.09
Hard Sandstone.....	89.4	—
Neat Portland Cement.....	89.5	—

*Laid down in Plasterston District.

REPORT ON ABSORPTION TESTS.

Material.	Hours soaked.	Per cent. absorbed.
Basalt A, B, and C.....	72	Mere trace.
Penlee Stone.....	78	"
Clew Hill "Granite".....	72	"
Clew Hill Dhu Stone.....	72	"
Wicklow "Granite".....	78	"
Guernsey "Granite".....	72	"
Black Limestone, Mumbles.....	29	"
Sweldon.....	54	8.7
Cwymnogydd, Tongwynlais.....	102	15.0

ary thrusting. The results of these experiments were carried out by Arch. C. Elliott, Professor of Engineering at the Cardiff University College. The specimens included three samples of basalt, and cubes of Penlee and Clew Hill Dhu basalts, Cornish, Clew Hill, Wicklow, Guernsey, and Aberdeen granites, Mumbles, Sweldon, and Cwymnogydd limestones, sandstone, and neat Portland cement. In the thrusting tests three sets

jected to rapid motion against the ribbed sides of an iron cylinder in a manner calculated to reproduce the action resulting from vehicular and other traffic. The reports on this test and on that by absorption are given in accompanying tables.

These experiments, it should be observed, have been specific and precise in character. Very little information has hitherto been available as to the qualities

of macadam in common use, and the failing of that which has been forthcoming, except as regards thrusting tests, which only affect the stone in one respect, so to speak, is that it has been vague and general. So far as can be ascertained, macadam has never before been subjected to experimental attrition in this country, and no such machine as that specially constructed at the Cardiff University College for attrition tests exists in the United Kingdom. A German professor once carried out some experiments on these lines, and the French government some years ago instituted similar tests; but so far as this country is concerned, where street mud is so vexed a question, Cardiff (where about 30,000 tons of mud are collected off the streets every year), thanks to the Western Mail, leads the way in practical experiments.

Advance of Wages with Improved Methods of Production.

The figures give conclusive proof that in every branch of industry, especially in all the arts which have been most fully developed by the application of science and invention, there has been a progressive advance in the rate of wages or in the earnings of all who are occupied on the farm, on the railway, in the factory, or in the workshop. This advance has been subject to temporary reductions during periods of commercial crises, usually very moderate. In such periods there is apt to be unemployment for a portion of the working force rather than any considerable reduction in established rates of wages. These periods are usually of short duration, and from each small decline wages have taken a speedy upward trend. This advance in all rates of wages has been coupled with a general decline in the prices of nearly all products. In some branches of industry the advance in the rate of wages has been less than in others. When each of these cases is dealt with, usually one of two causes will be found. In many arts the progress of invention has lessened the demand for individual skill and aptitude in the workman. For instance, in the

making of a steel plow a few years since nearly all of the workmen were of necessity skilled mechanics, earning relatively very high wages, yet such has been the application of machinery to the production of the plow that laborers may be called in from the adjacent fields who, if possessed of ordinary intelligence, may in three months or less become expert attendants upon the machines on which the separate parts that constitute the plow are made. Their wages are now as high as those of the skilled mechanics of a former generation while the men of the present generation who correspond to the skilled plow-makers of a former day have gone up into employments requiring even a higher type of individuality at higher relative rates of wages.—From "The Evolution of High Wages from Low Cost of Labor," by Edward Atkinson, in *Appletons' Popular Science Monthly* for October.

The Demand for Mausoleums.

We are hardly prepared to say that the increasing demand for mausoleums is due to any more pronounced objections to earth burial than have always existed. It might, perhaps, be explained by the fluctuations of demand, which occur in most lines of trade, and lead to the temporary boom in one class of production over another. It is clear, however, that the growing tendency to ostentation, observable in certain directions, may lead those financially able to indulge such weakness, into choosing a mausoleum for a family burial place and memorial, for the reason that it affords more display for a given amount of expenditure. This, added to the fact that it overcomes any prejudices that may exist against any earth burial, is a telling argument in favor of the mausoleum. Great improvements have taken place both in the design and construction of this class of memorials, and that there is a wide field to cover is evidenced by the range in cost between the unpretentious tomb designed to contain two or more bodies to that of the Pacific Railroad magnate, costing a quarter of a million dollars, or the Mackey mausoleum in Greenwood Cem-

etery, Brooklyn, of still greater expenditure. Another feature to note in the mausoleum is the distinctive quality of art that is being drawn upon for interior decorations—elaborate mosaic work and flooring, stained-glass windows of high artistic excellence, original designs in doors and grilles of cast bronze, all prove, not only the diversity of interests combining in the development of this field of memorial work, but that artists of ability must be called upon for their best efforts in these several departments.

Turning to the material of exterior construction, while by far the greater number of vaults are being built of New England granites, marble and Bedford stone are also being used for some very expensive structures. Diversity of material, as well as of design, is, of course, desirable, and to avoid monotony, necessary; but no less care is required of one than the other in certain respects, for a memorial, faultless in design and construction, will fail of its purpose if built of material incapable of withstanding the rigorous climatic influences to which it is exposed in most cases. Design and construction, however, are the two governing features of the mausoleum. The architect who can design a palatial residence or a monster business block, frequently fails completely in carrying out his plans for a mausoleum, which on paper appeared to be a "pretty design." Construction of this class of memorials has not received that careful attention so essential to their permanence, and in view of the increasing demand, it is of the utmost importance that both their design and construction should be entrusted to those who by practical experience have proved their competency for such work. Mistakes which can be remedied at comparatively small cost in many phases of monumental work are generally disastrous in mausoleum practice, for although the principles involved are few, they are vital.—*Monumental News.*

Building in Mexico.

The foundations of the ordinary buildings are of a very hard, porous and angular lava rock, which is laid in cement

mortar and well grouted. The cement adheres to this stone most tenaciously, owing to its being porous, and it is very difficult to remove any portion of the wall, if need be, in after years.

In the better class of buildings the foundation walls are faced with a square stone quite similar in appearance to the above, with the exception of being dressed on its face and four edges, the back being left rough for the better adherence of the mortar. The joints are not filled with mortar until after the completion of the outside work of the building, after which they are filled with a mortar colored black, and which is not only put in the joint, but on either side for half an inch. It produces a very untidy joint, but is quite serviceable.

The watertable course is usually cut out of a light grayish colored stone, very easy to work when first quarried, but hardening with exposure to the air. Upon this course of stone, which usually extends the full depth of the wall, is laid three or four courses of common red brick, somewhat larger than the brick used in the United States, and of poorer quality. Upon these brick are laid blocks of tepetate, a substance not unlike a concrete block in general appearance, but much inferior in quality. It is cut out of the ground with spades, in similar manner to that in which peat is gotten out. These blocks are about 14x10x8 inches in size, and run fairly well as far as uniformity of size is concerned. This tepetate is of a very soft nature, full of pebbles, about as large as a pea, held together by a yellowish cement, and is very light in weight.

These blocks are laid in the wall without any more mortar than is absolutely required, and very frequently without enough. These blocks are laid in courses of six or seven in height, when another string course of four or five courses of bricks are laid, and continuing in this manner until the cornice line is reached. The corners, the window jambs, and at intervals of about eight feet, are built of brick, these intermediate piers being full depth of the wall. The object of these string courses and piers is to give strength and solidity to the wall.

The outer joints of these tepetate blocks are filled with a cement mortar into which are placed small sharp edged stones. It is difficult to conceive what these are for, as the outside cementing adheres very strongly to the blocks. After the stonework is all done these walls are given a heavy coat of plaster, which, when dry, is of a dirty grayish color, which is sometimes remedied by an application of a water paint.

Owing to its inexpensiveness this tepetate is used extensively in buildings and walls enclosing train yards and gardens.

There are many varieties of stone used in buildings here, some very good and others very poor. It can be secured in different sizes, shapes and colors, gray predominating, although there is a very delicate shade of pink used.

The stone is brought to the building in the rough, and then worked into the various shapes by native stone-cutters, who work mostly by the piece. They begin work as soon as they can see and keep at it until it is dark, and do some very good work. The stone is quite soft, but soon hardens when exposed to the air.—J. L. Bothnell, in *Architecture and Building*.

The Power Necessary to Move the Earth.

Statisticians sometimes have queer ideas. One of them has amused himself by calculating how much energy, water, and coal it would take to move the earth a foot, supposing that it was subjected throughout its mass to a force equivalent to terrestrial gravitation. This is a gratuitous supposition, for in spite of its enormous mass the earth *weighs* nothing, and it is only by piling up hypotheses that we can get an idea of Archimedes' famous lever. Starting with the fact that the earth's mass is about six thousand one hundred million-million-million tons, our statistician calculates that we should require seventy thousand million years for a 10,000-horse-power engine to move our globe a foot. The boiler that should feed this engine would vaporize a quantity of water that would cover the whole face of the globe with a layer three hundred feet deep. The vaporization of

this water would require four thousand million-million tons of coal. This coal carried in cars holding ten tons each, and having a total length of thirty feet, would require four hundred million-million cars, which would reach eighty million times around the earth. This train, moving at the rate of forty miles an hour, would take more than five million years to traverse its own length. It would require for storage a shed that would cover a thousand times the area of Europe. If we realize that this fantastically huge amount of energy is as nothing at all compared with what the earth possesses in virtue of its rotation about its axis, its revolution about the sun, and its translation in space with the solar system, of which the earth is but an infinitesimal part, and which itself is but an infinitesimal part of the universe, we may get some idea of the importance of man in the universe, and estimate his incommensurable pride at its just value.—*La Nature*, Paris.

A Big Mexican Contract.

The firm of O'Connor & Smoot, Houston, Texas, has a large contract with the Mexican government for jetty work, the extent and nature of which were made known by Mr. Smoot, who said to the *Houston Post*:

"Yes, it is true that we have been negotiating with the Republic of Mexico for the performance of certain works which involve the expenditure of considerable money, but as the preliminary papers have not yet been completed, I am not at liberty to state exactly what the various improvements are to be. They embrace, however, extensive works in connection with railroad and harbor improvements, which will take several years to complete. At the present time the City of Mexico is the railroad center of the country, and in its position is too far away from the American border and from the Pacific to be of the advantage this enterprising republic wishes to obtain as a result of its richness. The only connection just now with the Gulf, or the only one of any prominence, is by the way of Guaymas, and even this is not

of sufficient strength to make it at all a leading factor. Most of the transportation is by way of El Paso and through Arizona to the Pacific, and this involves considerable hampering, because of the customs duties existing on the border. The Mexican government wishes to get rid of this incubus, and to have direct connections of its own with the gateways of the Pacific ocean. In order to make a proper terminus for the proposed railroad improvements, it is necessary to make changes in the present harbors, so that they will be able to accommodate the traffic. Of course, what these various changes are to be I cannot make public just now, although there has been something said about what is to be done in connection with the railroads."

"About what amount of money will these contracts call for the expenditure of?"

"About \$35,000,000," was the reply.

Preserving the Ruins.

One of Ireland's magnificent ruined castles came to its final end in this manner: The ancient seat of the Castle-reaghs overlooked Lough Swilly, and it was one of the most princely residences in Ireland. Eventually it fell into decay and was not inhabited.

As usual in such circumstances, when the peasantry wanted to build a pigsty, repair a road, or anything of the sort, they took the stones from the ruined castle, which was disappearing piecemeal, when one day the then Lord Londonderry paid a visit to his Irish property. When he saw the state the castle was in, and reflected on the fact that it was so much identified with the history of his family, and even as a ruin was a glory of Ireland, he determined to put a stop to the encroachments that had been made upon it.

Sending for his agent to give him orders that the people were no longer to remove stones from the building, he in-

structed him to have the place inclosed with a wall six feet high and well coped, to keep out trespassers. That being done, he went his way, and did not return to Ireland for three or four years. He then found, to his amazement, that the old castle had completely disappeared, and in its place there was a big wall inclosing nothing. Sending for the agent, he demanded to know why his orders had not been carried out. The agent insisted that they had been.

"But where is the castle?" demanded the marquis.

"The castle, is it? Bedad, I built the wall with it, my lord! Is it for me to be going miles for materials with the finest stones in Ireland beside me?"

In telling the man to build the wall, Lord Londonderry had said nothing whatever about preserving the castle, which is now a thing of the past. Nevertheless, the wall is a good one.

Groton Granite.

Few people realize how the granite business in Groton, Vt., has flourished during the past few years, and fewer realize what possibilities lie about only waiting for a little capital, push and energy to bring them out into material successes, says the Montpelier Patriot. Three years ago Groton granite began to be worked. The first move was made when Webber opened his quarry. Now there are over fifty men employed in the granite business and this number is being increased every month. It is stated by the townspeople that the stone is as good, if not better, than any in the state. It is free from iron and takes a polish easily. As to the quantity, no fears need be held, as there is enough to keep all the men who go into the business working day and night for many years, providing they have the orders to require such labor. The facilities for shipping the output are good, and that is one of the most important items to be considered.



Peach Bottom Slate.

In regard to Peach Bottom roofing slate, a writer in the Delta, Pa., Times and Herald, says there are thousands of tons of loose rock lying loose on top of the ground, in the Peach Bottom district, in a perfect state of preservation, after having been exposed to the weather for many thousands of years; and many buildings were covered with roofing slate made from these loose top rock in the olden time, and many buildings still stand in the vicinity of the quarries covered with such material a hundred years or more ago, before the process of slate manufacturing was known to the people. Nevertheless, the old roofs are just as sound to-day as any roof covered this season.

The late capital of Pennsylvania was covered with the Peach Bottom slate about one hundred years ago, and if the building had not burned down the roof would have remained sound as long as the building would have stood, as the materials are durable as any that ever come out of the quarries; in fact, the Peach Bottom slate is durable as the mountains, and, beside that, they are the best fireproof slate known, as one or two instances will prove the correctness of our assertion. In the early 60's the warehouse of the late firm of Davis & Pugh, of Port Deposit, Cecil county, Md., was covered with the Peach Bottom slate, a large fireproof building, and shortly after the said building and roof was completed, a large sash factory and lumber yard right aside of it took fire and burned down; and the heat was so

intense on that side of the building that it burned off all the spouting and heated the slate on that side hot enough to scorch the sheeting boards underneath the slate. And Mr. Davis said, in order to save the building he put his hands to carrying water up to the attic and throw it against the sheeting boards on the inside, to keep the fire from blazing out. And when all was over, to the surprise of every one, not a slate on the roof was broken; and the roof has never leaked a drop to this day.

The other instance was a power house of Messrs. Liphard & Shoman's sash factory in Columbia, Pa., a brick building adjoining the factory and covered with Peach Bottom slate. The said factory burned down, but the Peach Bottom slate roof, notwithstanding the intense heat, saved the engine and boilers uninjured, while all the spouting was burned off the engine and boiler house also.

In cold weather the quarry hands often use a piece of roofing slate over the fire to warm their lunch, and even fry their meat on it, then return it to the slate pile again.

The Peach Bottom roofing slate are considered better lightning protectors than any lightning rod ever made; and in our opinion buildings covered with Peach Bottom slate have the best of all protectors.

But for several reasons the Peach Bottom roofing slate is the most expensive slate to manufacture of any slate, probably, in the United States; and the slate cannot be manufactured to compete in price with many cheap and worthless

slates, now so plentifully on the market, and some of them dear at any price.

One reason that our Peach Bottom slate is more expensive to manufacture is that our slate rock stands perpendicular on top of a ridge, and dip down into the ground to such a depth that the bottom of it has never been discovered. Yet the deeper the better and purer is the slate. But every foot downward adds to the expense, as the flow of water increases and hoisting becomes more difficult. The expense of blasting this slate is much greater, perhaps, than that of any other slate in America, as they are exceedingly strong and tough.

The Peach Bottom slate is estimated to be about six times as strong as the best marble; or, in other words, that a slab one inch thick will bear six times as much pressure or weight as a similar marble slab. If that is correct, many thousands of tons of valuable material that could easily be manufactured into building blocks goes over the dumps every year. Slate stones are considered the strongest of all stones to bear weight, and this fact is worthy the attention of all architects and builders who desire strong walls and sound roofs.

Another item of expense in manufacturing the Peach Bottom roofing slate is that the blocks to be split must be cut or sawed to the length or size of the roofing slate from twelve to twenty-four inches in length, and split from the end, as they cannot be split from the side to the right thickness, while some other slate will split from the side or any place where a chisel is driven into the proper thickness of roofing slate, some ten feet in length. For instance, a quarrier can split more roofing slate in most of the Lehigh and Northampton county slate quarries in one day than he could split in Peach Bottom in two or three days. Then the Peach Bottom roofing slate cannot be made to compete in price with such roofing slate, but when the quality and durability of the Peach Bottom roofing slate is taken into consideration, they are the cheapest roofing slate in the United States to-day, and worth many times over the difference in the price, over all competitors, to all who desire a good, honest,

desirable, safe, and genuine slate roof. No better quality of slate has ever been found in the world. Neither gas nor acid, cold nor heat has any effect on the Peach Bottom slate, and they are used for many different purposes beside roofing. A party here has a large slate chest, that will hold some three or four barrels, to hold vinegar, which has been in steady use for that purpose for some twenty-five or thirty years, and sound to-day as ever.

There is nothing in the nature of the Peach Bottom slate to fade or decompose, and York county, Pennsylvania, and Harford county, Maryland, has the just right to boast of having as good quality of slate as has ever been found in any part of the world, and in our humble opinion, the king of all slate.

Roofing Slate in South Africa.

In answer to a New York correspondent, Consul-General Stowe, at Cape Town, writes on August 10, 1898, that no roofing slates are imported into South Africa from the United States, although more than a million were imported last year from the United Kingdom, and thirty-two odd thousand from Belgium, the demand for them being on the increase. He gives it as his opinion that they are inferior in quality to many of those used in the United States.

Hamburg Slate.

There is an industry near the village of Hamburg, N. Y., of which the public knows little, but which promises to become a leading factor in the business affairs of this country. Bangor, Wales, is known the world over for its slate mines. The Hamburg slate, the true worth of which is just becoming known, is said to approach the quality and color of the Wales article, and furthermore that the local deposits are the only ones found in the United States that are so valuable. This slate industry is being developed by the Hamburg Slate Company, a corporation with a capital of \$30,000, which was organized a few months ago under the state laws. The

chemical analysis of the slate found there shows it to contain 67 per cent. of silica, $2\frac{1}{2}$ per cent. of iron, $13\frac{1}{2}$ per cent. of aluminum, 5 per cent. of alkalis, and the loss on ignition is 8 per cent. The color of the slate is black, and upon heating to a red heat the edges show only slight flaking when cold. The lower down the strata the more perfect appears to be the texture and the more beautiful the hue. Experts a few months ago when shown samples of the slate doubted the statement that they were taken from the Hamburg mine, but all doubting Thomases have since been convinced that right here is a slate in apparently unlimited quantities which probably has no equal in this country.

What is peculiar about this slate is its perfect formation. It is said to be a fact that nowhere in this country is slate mined and put on the market in such large sheets as are taken from the Hamburg mines. Elsewhere the limit of dimensions is three to four feet square. We were shown perfect specimens of slate free from any pebbles, or "ribbons" as they are called in the profession, twelve feet in length and six feet in width. These sheets were sawn to the thinness of one inch, which is the standard thickness. We were also shown specimens sawed to an eighth of an inch in thickness by four and five feet in dimensions. This valuable deposit of nature's wealth is situated on the Jacob Zimmerman farm, three miles west of the village on the Eighteen Mile creek. The Hamburg Slate Company has a lease of three hundred acres. Indeed it would not be surprising if within the next few years we see scores of slate works in the immediate vicinity, as this rock formation extends for miles in either direction on the banks of the Eighteen Mile creek. It is also known that the shale in this vicinity contains gold deposits, as rock taken from the farm adjoining the Zimmerman farm has analyzed \$10.50 per ton pure gold.

The Hamburg Slate Company began work upon their plant only about three months ago, expending in the neighborhood of \$10,000. They are now in full working condition, having a capacity of

output of 2,000 feet per day, and so successful have been their operations and the constant demand of the market for the genuine article that the capacity of the plant is now to be doubled. Hamburg citizens hope to see the plant soon giving employment to one hundred men which may be an accomplished reality in a comparatively short time. The product is used in building purposes for mantels, wainscoting, tiling, water closets, billiard tables, blackboards, and a hundred other purposes.—Cor. Buffalo (N. Y.) Commercial.

Northfield, Vt., Slate.

M. D. Smith, secretary of the Northfield, Vt., board of trade, says he cannot see why, if the business was developed, Northfield could not be in the slate market to the same extent as Barre in the granite world.

In the first place the supply of slate at Northfield, he says, is unlimited, as the hill east of town is full of it. Then again, although the deposit is covered, protecting the quality, it is but five or six feet below the ground, just under the frost line and easy to get at. The quality of the slate is unsurpassed and by all odds the finest in this country. It splits thin, making little or no waste, holds its color, is durable, and a piece 10x18 inches, and of standard thickness, stood as a test a weight of over 350 pounds. The piece used was taken at random from a pile and the first test was a success.

In answer to the question as to whether the demand for slate was as large as ever, Mr. Smith replied that the price of slate was higher than ten years ago, and although there were lots of patent roofs on the market, slate was the best for nearly all purposes of that nature.

There are seven unused quarries about the town, but it is thought that it will be as cheap to open new ones. These old quarries were not successful financially because of lack of capital and mismanagement.

At a recent meeting of the board of trade, Mr. Richard Griffith made a report as follows: "I have seen the Union Slate

quarry, where many thousand squares of good slate have been taken out, and many more may be had. The way to work this quarry is to follow the vein directly north. The Governor Paine quarry looks well. The top stones are large and good joints run from the top to the bottom. Many of these large stones could be worked into sidewalks. The proper way to work this is to get the face from the west and work it down. The Owens quarry is very large, with two sides, but is badly filled up with rubbish. A good outfit of machinery is needed. The Keyes quarry is clean from rubbish, but the slate waves and most of it makes small sizes. The quarry is not deep enough to get the best portion of the rock. In the John Clark quarries there is some curly white flint in some parts, but these are to be found in the best of quarries. In the Dole-Brill quarry the rock is very regular and the color is very good. The ground above the quarry is even and moist, and for that reason there will be but very little waste in the top. This vein in Northfield is thicker than any I have ever seen in this country. New quarries can be opened cheaper, perhaps, than the old ones can be worked. By opening new quarries there would not be a great amount of rubbish to remove. A peculiar fact about the slate deposit in

Northfield is that it is near the surface of the ground, but admirably protected from exposure to the weather. It is the opinion that slate can be quarried at a good profit here if the right kind of management takes hold of the enterprise. A test of the strength of the slate was made at the Dole-Brill quarry lately, and it was found that a piece $\frac{1}{4}$ -inch thick and 10x18 inches long sustained a weight of 300 pounds."

About half the employes of the Bangor Excelsior Slate Company, at Bangor, Pa., have returned to work at the reduced rate. They are principally residents of the neighboring towns. Superintendent Lloyd and the employes of the Bangor Union Slate Company had a conference, but the men did not return to work. Offers of financial assistance are coming in from other nearby slate districts.

W. F. Overly, of Greensburg, Pa., has secured the contract for putting slate roofs on the Ford plate glass works, at Toledo, O., the cost of which will run from \$15,000 to \$18,000. From sixty to sixty-five carloads of slate will be required and the freight will cost \$4,500. The roof surface aggregates about ten acres.



CEMENTS AND LIMES.

Short Stock of Portland Cement in Chicago.

Chicago stocks of Portland cement are lower than for many years, and in some directions fears are entertained lest the shortage develop into a famine which will materially affect all the large building operations in which this material is extensively used. Owing to the strong demand and light supply, prices have advanced 10 to 15 per cent., present quotations being \$2.25 per barrel. In explanation of the trade situation an official of one of the larger cement companies said:

"A shortage developed last fall, but too late in the season to make it possible to fill the gap by importation. Imported Portland cement would hardly meet the requirements of the trade in this country, anyway, for a vastly superior article is made in this country. Even had it been desirable to import cement it is doubtful if it could have been obtained, as much larger quantities than formerly are being used there, making a foreign as well as domestic shortage.

"An immense amount of labor on railroad and public works which was suspended during the panic has been resumed, requiring a large amount of material. The government has used unusual quantities in the construction of fortifications.

"By next spring the daily output of the cement factories in this country will be double that of the spring of 1898. The demand will also increase, but I believe the supply will exceed all require-

ments. The shortage is confined to Portland cement, which is regarded as superior to all others."

Railroads are making heavy inroads on the visible supply of cement. One roak running through the central part of the state would, it is said, like to have had 8,000 barrels before Oct. 1, but could not get them.—Tribune.

A Pennsylvania firm has devised a steel bucket used for placing concrete under water in building a pier, after it is found impossible to free the coffer-dam from water. The bottom of the bucket is closed by two flap doors, which open when the strain on the trip rope is slackened, permitting the cement to discharge itself by its own weight.

New Method of Saving Old Brick Buildings.

The practical uses to which Yankton Portland cement can be put are infinite, says the Yankton, S. D., Gazette. At the state insane asylum a new use has been found for it which will doubtless create a considerable demand for the material. The old brick building in the center of the hospital was becoming weather worn and was rapidly deteriorating, if not quite disintegrating, rendering some process for its preservation imperative. Dr. Mead conceived the idea of incasing it in Yankton cement and last spring carried the plan into effect. The building was treated to a

heavy coating of cement, finished with an antique Tyrolese effect which is most pleasing and which has converted the center from a plain, old-fashioned red brick structure into one of the handsomest public buildings in the state, and at the same time has rendered it impervious to the weather-wear so destructive to the unprotected brick. The expense of applying the cement was only nominal.

Burns, Kan.—The Southern Kansas Cement Company is getting ready to put in a stucco mill at Burns. The citizens of the town have donated a site for the plant and work will soon be commenced on the necessary buildings. The bed of agatite that this mill will work up is a large one, and will produce several thousand carloads. It is seven and a half miles from town, and the raw material will be hauled into town in wagons. This will employ about thirty teamsters.

Cements and Putties for Masons' Use.

Dissolve alum in water until the fluid will not dissolve any more, then mix in this sufficient plaster of paris to make a stiff dough and bake it; when baked hard and dry grind it to powder, and for use mix with water as wanted, and apply it like plaster. Various pigments may be mixed with it (while in the dry state, after baking and grinding) to make the cement imitate the color of any kind of marble it is required to cement or join. Joints made with this compound can be polished as smooth as glass, and thus the joint in the marble work may be rendered imperceptible.

The Point of Fineness.

Mr. C. B. Stowe, referring to the grinding of Portland cement at a recent meeting of the Civil Engineers' Club, of Cleveland, said he found, in testing some foreign cements, that about 60 per cent. would pass through a 200-mesh sieve, and about 80 per cent. through one of 100 meshes. He had made some tests

recently to ascertain the point of fineness at which cement ceases to be cement and becomes practically sand, and found it to lie between the 200 and 400-mesh sizes. It was also found that much depends upon the mixture of materials before burning, the strength being about in proportion to the amount of mixing where the fineness is 200. He had some clinkers from which a sand test would go higher than a neat one, and had found that a cement might be so fine that it will crystallize in a neat test in such a way as not to carry the strength.

One of the mills of the Salina, Kan., Cement Plaster Company, at Acme, Tex., burned and was a total loss. The burned mill was the oldest structure of the lot, coming to the company in their recent purchase. They have two other mills there, so that the business will go on without interruption. The loss is estimated at \$5,000, with an insurance of \$2,500. The company will probably rebuild and on a larger scale.

About forty men are at present working on the new plant of the Chicago-Portland Cement Company, which is located near Oglesby, Ill. Seventy carloads of material and machinery are already upon the site selected for the erection of the plant, and the foundations are nearly completed. The buildings, which are of very large dimensions, are expected to be constructed by November 1, and the manufacture of cement will in all probability begin sometime during December. In the neighborhood of one hundred men will be employed at the mills upon opening, and this force will later be largely increased.

A Light Cement.

A new fireproof cement is being made for building purposes, that weighs thirty pounds per bushel and costs fifty cents for that amount. It is intended to supercede cement in fireproof buildings, and exhaustive tests are now in progress.

The following experiments have been

tried with the new cement: Two bricks each $9 \times 4 \times 2\frac{1}{2}$ inches were made. One was placed on top of a very hot coke oven with a strong draft. At the end of two hours' exposure to this severe test, only a depth of $\frac{1}{4}$ -inch of the fire surfaces are charred, and it was possible to handle the top of the brick with bare fingers without inconvenience. The other brick was placed in the full blast of a coke burning boiler furnace and in half an hour was only charred to a depth of $\frac{1}{2}$ -inch. When broken, this brick was found to be only slightly warm in the center. A piece of the material was subjected to a gas blow-pipe, but was little attacked after one-quarter of an hour's continuous action and never caught in a flame—Unidentified.

Importations of cement at the port of New Orleans from January 1 to December 31, 1897, 271,795 barrels; 1898, to August 31, 155,083 barrels.

Marl at Lake Maxinkuckee, Ind.

Prof. Scovell, the Terre Haute, Ind., scientist, who has taken more than one thousand soundings in Lake Maxinkuckee, made an investigation of the marl beds at the request of State Geologist Blatchley. He found the deposit at least eighteen feet thick where the water is from eight to fourteen feet deep, but how much thicker he could not tell with the instruments he had at hand. The deposit, so far as could be judged without making a thorough analysis, was of a superior quality, having a large proportion of carbonate of lime, which makes it valuable in the manufacture of cement or as a fertilizer. At greater depths there also was marl, but it contained less carbonate of lime.

State Geologist Blatchley will make an

analysis, and if the quality warrants he will officially call attention to the presence of the deposits, to the end that the manufacture of cement may be engaged in on the lake shore. There will probably arise a question as to the ownership of the deposits, but it is thought the courts will hold that they belong to the government and that the right to remove the deposits will have to be obtained from it.

The Dickinson Cement Company has set a force of men at work tearing down part of the old building on the site of their new plant near Deer Park, Ill., and otherwise preparing the ground for the erection of the new structure.

Michigan's Marl Deposits.

"Michigan is on the eve of revolutionizing the cement business of the world," said William L. Holmes, president of the new company which has been laying plans for a year, and which has enormous buildings nearing completion. The company's expert found apparently inexhaustible beds of marl and remarkably clear clay. The company is capitalized at \$2,500,000, and has one thousand acres of marsh. The buildings, which are situated on a chain of lakes near Coldwater, are entirely of steel and glass. They will have a capacity of 1,000,000 barrels a year. English capitalists have already made an offer for the entire output of the fields.

It is said Leitchfield, Ky., is to have a cement factory. Representatives of a large concern have purchased the L. Moorman farm, advancing ten per cent. on the deal. The factory will employ about three hundred hands.



TIMELY TOPICS

The Outlook for Building. Most everybody who is in touch with the building business must concede that the conditions looking toward prosperity in that line are unusual at this season of the year. We do not recall a time during the dozen years STONE has been a factor in the industry of stone production and manufacture when at this time in the business year matters were more auspicious. The American Contractor, which through its extended correspondent relation with the building interests, may be accepted as a reliable reporter of affairs, says:

"The situation continues to be one of auspicious promises. We no longer are compelled to depend for data upon general trade statistics, and argue therefrom an improved outlook for building operations. The situation has crystallized into something much more tangible and definite. Reports which have reached us from a hundred sources all over the Republic, show the increased volume of building operations now being prosecuted. Direct comparative statistics with previous years corroborate and verify the increase in disbursements for building construction this fall. With the general business of the country in its aggregate far in excess of any previous year, it would indeed be strange were we not erecting new buildings of every commercial kind to handle it. And that this is being done is clearly attested by the re-

cent building records of nearly all the cities of the Union. This is the season when the work of the building year is usually wound up. Not so this year. On the contrary many architects are unusually busy, and the work coming forth from some offices is out of all proportion to the time of year. It is evident that there will be very little of a winter between now and the spring of 1899 as regards building operations. Another reason why so many new projects have come forth during the past forty-five days is to be found in the fact that a great number of plans were temporarily shelved pending the termination of the war.

"This new era of expansion which is just dawning for the newer cities of the central west will certainly not be characterized at an early day by any record-breaking realty speculations or building construction epidemics. Many of the business concerns of these cities have recently been in a state of critical convalescence, financially speaking, and the process of regalanizing them, through the instrumentalities of prosperity, into their erstwhile thrifty condition, is certain to be more or less a tedious one, consuming considerable time. It is important in the restoration of prosperity in these newer cities of the Mississippi valley, that the non-resident capitalists whose aid will be solicited, should understand the existent condi-

tions. New men with new energies, un-
ennervated by the demoralizing influences
of '93 and '96, will be necessary to carry
forward the development of these cities
commercially and industrially. Much of
the 'new blood' which poured into them
in the later eighties, pregnant with life,
courage and enthusiasm, has been ex-
hausted by these recent years of financial
reverses. Many of them were submerged
and financially drowned in the flood of
indebtedness which overtook them. It
will take a lifetime for many who have
stayed, to wipe out the long lists of their
creditors. So that fresh, unimpaired
manhood, as well as fresh, unimpaired
capital, will be in demand—and is de-
manded now—to continue to handle the
rapidly augmenting trade."

The Bedford

Stone Industry. Some folks who don't
know much about it,
think Bedford quarry-
men are the most fortunate set of fellows
in the business; other folks, who know
something about it, declare if they are
not fortunate it's their own fault, while
still others, who claim to know all about
it, assert as a positive fact that Bedford
quarrymen have not yet realized when
they were well off. We are inclined to
give precedence to those who claim to
know all about it. Some fortunes have
been made in quarrying Bedford stone.
A great many more have been lost than
made, however. The industry is not yet
aged a score of years, but of the pioneers
only a few are still at it, and none of
these, up to date, have made enough out
of the business to buy a bank or build a
railroad. Maybe, they have not realized
when they were well off. And then,
again, maybe they do. Let us see: About
ten years ago a couple of eminent scientific
gentlemen were sent from Germany into
Indiana to report on the limestones and

clays of the state, as to their chemical
qualities for the production of the best
kind of Portland cement. They spent a
month or more in their investigations,
and reported that from the materials
found a Portland cement, equal if not
superior to that made in Germany, could
be manufactured at half the cost, and
there was no limit to the quantity of raw
material available. For awhile, it was
believed large investments of capital
would be made in this industry, but
nothing came out of it, and to this day
there is only one Portland cement mill in
Indiana, that at South Bend.

Indiana has now, and has had for a
couple of years, a state geologist who is
content to earn a small salary in doing a
powerful sight of good. He's an adver-
tiser of expert accomplishments, and his
investigations and reports are attracting
to the state immense sums of money for
investment. He has taken up the hint
dropped by the German experts ten
years ago. He tendered a suggestion to
the Portland Cement Company, of Utah,
that it attempt to make a cement of Bed-
ford rock and shale. He had studied the
chemical makeup of the two and believed
they would combine to make a cement.
On the strength of this suggestion the
company sent representatives to Indiana
to look into the matter. Bedford rock
and Jackson county shale were shipped
to Salt Lake City for a test. Apparently
it was satisfactory, for rock and shale
land has been secured by the company,
and it is said it will erect a \$125,000
plant near Bedford. The test shows that
the cement is equal or superior to Port-
land cement. It is made up of 77 per
cent. rock and 23 per cent. shale.

Herein it is that owners of Bedford
stone land probably have not known
when they were well off. While they
knew they produced one of the highest

grade building stones to be found in the earth, they have not until now been aware of the inestimable richness of their enormous spall banks. Maybe this discovery will have to do with settling several disturbing matters involving the Bedford stone industry.

The Mission of the Machine.

The "other side" of the question—machine vs. hand-cut stone—being in this instance a defense of the machine, is presented in this issue by Mr. F. R. Patch, a prominent manufacturer of stone-working machinery. Mr. Patch knows whereof he writes. It has been his business to take into account all the objections presented against the machine-method of stone-working, and to design and perfect his machines so that these should be overcome by practical demonstration. That he has done so the success of his firm in selling machines is proof positive. And he shows why, in his article, this success, and that of other manufacturers of different types of stone-cutting machinery, has been achieved. The machine performs successfully the functions for which it was built. Leaving the sentimental part of the argument out, it is clear that no logical reason can be shown why the planing and moulding machine should not be preferred, on economical grounds, above the hand cutter, and that is the essential purpose in the introduction of all machinery that displaces manual labor. It is adopted because it lessens cost of production and increases, at same time, the capacity to produce. If stone is to hold its place as a building material, it must be brought more nearly to a level, all things considered, with the materials it competes with. It is not nowadays so much a question of the better thing, as it is of a thing that can be made suitable. It is very unfortunate that this is so. We

may express contempt for the bad taste shown in selecting the material for a public building, but while the band-box style of construction answers the money-making purpose of its creation, the best thing to do is to get stone, marble and granite down as near to a competitive basis with brick, terra cotta and concrete as it is possible to do so. The stone-working machine, simplified and efficient, is likely to bring this about at no distant day. It could never be accomplished if the reliance was solely on manual working of these materials.

It is true that the tendency is already apparent to contract the use of artificial building material and to a more liberal use of the natural. The Eastern form of construction is a vast improvement on the "Chicago style"—there is more of stone, marble and granite in it, and this quantity is sure to increase as builders live out the speculative era and enter the renaissance of the substantial.

Publicity is Capital.

A large Eastern manufacturer who has done a great deal of advertising in trade publications, and has advertised in *STONE* for more than eight years continuously, has this to say in explanation of the policy pursued: "I advertise to be KNOWN—to KEEP KNOWN. I employ salesmen to sell my goods. I do not want my representative on presenting his card to be met with the query: 'I never heard of your house; how long have you been in business?' We recognize that PUBLICITY IS CAPITAL, and we spend thousands of dollars to keep our house before the public, and our salesmen have a great advantage over rivals who do not see the value of publicity." This man has the correct idea of trade journal advertising. It is not the function of the medium to *sell* the goods found advertised in it. No one

buys a rock drill, a channeler, a saw gang or a planer, simply from seeing the thing advertised. He calls at the manufactory to investigate it, or he goes where the thing is in operation; or the manufacturer's agent calls on him and explains its practical operation and produces evidence from parties having it in use. From his own conclusions he buys or not. *The advertisement did all it should be expected to do when it made the advertiser known to the user of the thing he has for sale.*

Windowless Buildings. The American architect who has presented the plan of a windowless skyscraper may not wait long to find that type of building become popular in every large city. There are innumerable tenants to be found among those who want "to keep it dark," in nearly every line of business nowadays. Why, Chicago alone could fill a mile row of such buildings with promoters of Klondike mining enterprises, wild-cat investment brokers, and bobtail benefit companies, while the array of straw-bailers, money-lenders and "respectable citizens" who fatten on tax sales and franchise grabbing are as numerous as chimney-pots. Seriously, however, the windowless building has much to recommend it from an esthetic as well as a financial view. The fire hazard would be less, because exposure to fires in adjoining structures would be minimized; the roar of the street's traffic would be shut out; the smoke and dust-laden air would not penetrate, and the ozone furnished the breathing world within its walls would be purified and perfumed with the most rarified odors which chemical science could produce; the artificial light, in this era of electricity and acetyline, could be given forth in any brilliancy and iridescence desired. And then, see what magnificent façades the

cultured architect could create. That feature certainly needs the touch of reforming genius. We might enumerate a hundred advantages of such a building. Who, among us, having grown weary of the commonplace in city architecture, would not welcome these "windowless palaces of rest?"

"Stopping the Paper." At last we have run up against the narrow-minded man who peremptorily orders us to stop his subscription to *STONE* because we admit communications that are sentimentally at variance with his views on how the stone-working business should be run. There's an excuse for the man who "stops the paper" for any reason except that. When a newspaper or magazine eliminates news or argument for the sole reason that some of its readers will not agree with what is printed, it becomes valueless as an exponent of honest thought. This subscriber concluded we ought not permitted Mr. Gorse to express his views favoring the stone-cutter as against the stone-cutting machine, or rather, hand-cut stone against machine-cut stone. There is much diversity of opinion on that subject. In the expectation that it might evoke discussion among practical men, and much knowledge be gained therefrom, we gladly presented the argument in favor of the hand-cut idea written by a very intelligent and fair-minded stone-cutter. A reply to this by a maker of machines, Mr. Patch, is found in this issue. Out of this discussion, which we hope will be taken up by others, much information and truth will be presented for just such narrow-minded individuals as the "old time subscriber" who has been reading *STONE* so many years, and absorbing it so thoroughly, that he imagines he chastises the publisher by casting it aside. He butts his head against a stone wall!



TERRE HAUTE, IND.

Since last report the contract has been let and work begun on a new distillery building which when completed is to cost somewhere about \$150,000. A. Fromme is the contractor. Aside from windows and door sills I don't know of any other stone in the building.

There is some talk of an addition to the Terre Haute Brewing Company building, to cost some \$75,000, but as yet nothing is being done.

The Minchall vault, which is being erected by the Terre Haute Stone Company, and is of Eastern granite, is now under way.

Also the new depot for the "Big Four" Railway Co. Work is progressing on it. The stone is of Bedford, which comes already dressed.

Prospects for stone work of any kind at this writing are not very encouraging.

I might also add that Labor day (Sept. 5) was observed as a holiday here by almost every one. A large procession, composed of the affiliated trades, and also a large number of coal miners from adjoining towns, was the program for the morning, after which all went to the fair grounds, where amusements of all kinds were to be seen, and all seemed to enjoy themselves. It was conceded that there was about 12,000 persons on the grounds. After paying all bills the Central Labor Union came out with over \$500 ahead. C.

PARKERSBURG, W. VA.

There is not much building news this month. Mrs. Mayhew will erect a fine new business block; four stories, with stone front. H. R. Warne, architect.

The stone work on the new bank building is nearly done. The keystones in the main entrance weigh six tons each. S.

PORTLAND, ORE.

The company which has the contract to furnish 10,000 yards of crushed rock for the fortifications at the mouth of the river are opening a quarry back of St. Helens, and will get the rock from that place. They are troubled to find laborers. They have secured a number of men who have returned from the hop fields, and as more men are daily coming in from the hop fields and harvest fields, they hope that labor will soon be more plentiful. They pay \$1.75 per day, which is evidence that better times for workingmen have arrived, as the highest wages laborers have received during the past eight or ten years was \$3 per day. Rock men on railroads are getting \$2 a day now in some places, but the wages of ordinary railroad laborers is from \$1.65 to \$1.75.

There are plenty of men about town who are willing to work for \$1.50 per day, but they do not want to leave the city. Winter is coming on, and they want to be within hail of another job, if one gives out.

BEDFORD, IND.

The shipments of stone from the Bedford quarries in August, over the Monon, were the largest in any one month since the quarries have been worked.

FORT WORTH, TEX.

The stone industry is picking up a little in the Lone Star State. Bids were opened here September 10 for the Orphans' Home, to be built by the Masons of the state. Texas Construction Company were awarded the contract at \$17,500. Brick and stone basement and stone trimmings.

Bids will be called for in a short time on the new bank and office building to be erected on the corner of Seventh and Main streets, by Mrs. John R. Hoxie, of Chicago. It is to be a six-story building, of steel, brick, terra cotta, and Ohio stone.

The union depot—It is still quite hard to say what will be done about it.

There are several jobs of stone work going on in the state; a college at Georgetown, a fine church just starting at Victoria. No court house at this time being talked about that I can learn of.

A city hall at El Paso is to be let in the near future; to be of stone which will come from the red sandstone company at Pecos, which is the only soft stone quarry in the state that can furnish stone of any size.

KANSAS CITY, MO.

Work in the stone line has greatly increased lately, and all cutters are working. The Dugan Cut Stone Company has commenced on the second basin for the Paseo. It is of Bedford stone, all ornamental work, and is to cost \$9,300.

The building permits issued since January 1 to date amount to \$2,514,000, three-quarters of which is for homes. Besides this, Kansas City will this year expend fully \$1,000,000 for permanent public improvements.

PEORIA, ILL.

Peoria had a street fair during the past week for the first time. The managers in charge say it was a great success, and intend having it annually hereafter. The carpenters had considerable work in erecting booths for the display of the different varieties of goods.

The latest development in the building line is a free high school for Catholic boys, donated by Bishop J. L. Spalding, of this city, to cost about \$40,000. Front side, and end to be faced

with Bedford stone; opposite side and end to be of pressed brick.

The Central Railway street car company are making extensive repairs on their track, which they have torn up and are now replacing with long, heavy rails.

CLEVELAND, O.

Trade is exceedingly dull in this city at the present writing, and from all indications we will have a very poor fall. Quite a number of the craft have left the city. The only job of importance now going on is a double residence on the "avenue." There are about eighteen cutters on this job. In all, there are about sixty men working at present.

Cleveland generally makes a very lively spurt in the fall of the year, as if to make up for lost time, or to get finished before Jack Frost starts, but this season, I fear, will be an exception, as there seems to be nothing in store for us, and you can place the blame on terra cotta and iron, as they are the prime factors in two very large jobs now going on in the business portion of the city. Dame Rumor has it that the High School building is to be trimmed with the same "crockery ware." GEORGE.

Tough Tales Tersely Told.

HOGAN'S QUARRY HAS A NEW GHOST.

Officer Linhardt, of the Fifth District, unearthed the skeleton of a man at Hogan's quarry the other morning. The bones were submerged in the water. Evidently they had been there a long time, and nothing is known as to their identity. Efforts are being made, however, looking to an identification, but it will be strange if anything definite is ever learned.

In years gone by a good many persons have disappeared in the neighborhood of the old quarry, and there are those who believe it is haunted. A night watchman in that vicinity insists that on numerous occasions he beheld a weird form wandering around the quarry, and that each time the ghost had taken a bath in the waters of the pond. The watchman is said to be a truthful man, and temperate in his habits.

Several tramps have disappeared in the vicinity of the quarry, but the best police authority is that none of them ever took a bath. The police say that no self-respecting ghost of a tramp would take a bath. Tramps have no use for water, while the ghost in question seems to enjoy bathing.

Those who believe in ghosts, spooks and hobgoblins have examined the authorities on such subjects and expressed wonder that no one dropped to the hint that the ghost was trying to indicate where the bones were to be found, and in its own weird fashion tell the people to bury the bones.

George Washington Jones, an old negro, who lives at the foot of Battle Ax Row, and is said to be authority on ghosts, declares that the one at Hogan's quarry will not be seen any more, now that the bones have been discovered and taken from the water. He says that ghosts sometimes whistle through their teeth when they want to communicate something badly, and in such instances, no matter how much one may be frightened, he must try and understand what the ghost is driving at. According to his story he has seen a great many hosts in his time, and he is of the opinion that the one at Hogan's quarry formerly lived on Stinking River, at Chicago, and, having escaped from there, found Hogan's quarry, and noting the great difference in the water, went in swimming and was drowned.—St. Louis Republic.

A STONE THAT GROWS.

A West Gouldsboro (Me.) man tells a queer story about a stone that grows. It is an egg-shaped, flinty-looking rock, which he picked up in a cove near his home over thirty years ago. The stone weighed about twelve pounds and from its odd shape was kept in the house and on the doorstep as a curiosity. As the years passed the stone increased in size. Six years ago it weighed forty pounds and now it tips the scale at sixty-five pounds. The owner swears it is the same stone, and tells a likely story, with numerous witnesses to back him up.

LIGHTNING DOES QUARRYING.

On the farm of Benjamin Bates, in Monticello, N. Y., lies a boulder weighing about nine tons. During one of the recent thunder storms lightning struck it and cut it down perpendicularly, about three feet, and then horizontally about the same distance, exactly at right angles, detaching a block weighing about two tons, two sides of which are perfectly at right angles, and as smoothly cut as though quarried. The stone is of the class designated as Shawangunk grit or conglomerate, with here and there a flinty pebble, some of which have been cleanly cut in two by the lightning.—Watchman.

San Francisco, Cal.—One hundred feet down in the sandstone formation of the Contra Costa hills an ancient bed of clams has been found by workmen boring a long tunnel for the San Joaquin Valley Railroad. The spot where the discovery was made is fully three hundred feet above the present level of the bay and about five miles from the bay shore. The workmen had bored six hundred feet into the hillside before striking the bed. One of the tramway cars had been almost filled with shells before the men noticed that they were cutting out clams from the solid sandstone by the hundreds.

Martin Zeigler, of Astoria, Ill., while working in some creek that was quarried on Swepton Browns' place, near town, discovered a pecan inside of a solid rock. The pecan was also petrified, but was quite perfect in appearance and was indeed a curiosity.—Sparta Independent.

MACHINERY AND SUPPLIES.

[Matter appearing under this head is compiled and edited from data furnished by the advertiser, and should not be accepted as the opinion of the publishers.]

Don't lose sight of the fact that what may be called blue marble is not always true blue. We have known positive grays to be designated as blue marbles. A finished thing is not always proof of what it appears to be when judged in its crude form. That's what fools so many in selecting decorative stones. Judge stone as you would judge a piece of steel. Get beneath the surface. Put that test to the blue marble that the True Blue Marble Co., of Rutland, Vt., have been furnishing the public for building and monumental purposes for a quarter of a century or more, and you will find it stands the test without a flaw. And the suggestion comes in here that many builders have not yet learned the admirable fitness of blue marble for interior finish. Nothing in the list of marbles is more beautiful for wainscoting, balustrade, or counter.

All oölitic limestone denominated in commercial vernacular as "Bedford," is not genuine Bedford oölitic limestone by any means. There are as many varieties of "Bedford" as there are colors in the spectroscope. This fact should be understood by contractors and builders when they come to ask for estimates from quarrymen in the district. Producers of the genuine stuff do not refuse to guarantee its quality—and first quality is easily understood from the analytical reports that will be shown. So, it should be the rule of purchasers of high-grade "Bedford" to examine such reports and place their orders only with those companies that can show them. If looking for high-grade Buff one needn't go farther than to Bedford Quarries Co., Perry, Matthews, Buskirk Stone Co., Bedford Steam Stone Works, or for Blue to the Blue Hole Quarry, C. S. Norton Bluestone Co., or any of the others above mentioned. You may safely reckon on getting first quality and fair prices from every one of these concerns.

Much has been written, but not half has been said, in praise of Georgia marble as a building material. It is coming to speak for itself in greater praise than language can utter—in the magnificent public and private buildings that have in recent years been constructed of it, and are now in process of erection in many sections of the Union. The greatest factor in the Georgia marble building trade is the immense plant of the Georgia Marble Co., at Tate, Ga., the center of the quarrying district from which this choice material is derived. It has furnished the marble for numerous structures that

are masterpieces of architectural splendor—both for the exterior massive walls and for the delicate interior finishing. The capacity of the company for handling large contracts is unexcelled by any marble company in this country.

The Darlington stone, from the quarries of the T. L. Fossick Company, of Sheffield, Ala., is one of the very best oölitic limestones in the United States. It is of a light gray color, of fine, uniform grain, and perfectly homogeneous. It possesses the quality of cheapness from the fact that when newly quarried it can be easily cut and carved to any design required, however elaborate, and at the same time is strong and durable.

The oölitic limestone of the Darlington quarries is a massive formation with very few seams or fissures, and of great thickness and extent.

The plant of the T. L. Fossick Company is the largest and best equipped of any building stone plant south of the Ohio river. It is supplied with steam drills and steam derricks, steam channeling machinery, and has two large saw mills for sawing stone, each containing eight gangs of saws of the most modern and improved pattern. In addition to the dimension stone business the company is also operating quarries at Rockwood for the production and supply of fluxing material. From these quarries they are now supplying all of this class of material used in the Sheffield furnaces.

The following is a correct copy of analysis made of this stone at the United States government arsenal, Watertown, Mass., Nov. 20, 1895:

Silica (Si O₂) .50.
Ferric oxide (Fe² O₃) 1.45.
Lime (Ca O) 54.20.
Magnesia (Mg O) 1.23.
Carbon di oxide (C O₂) 42.61.

From the above it appears that the stone is of exceptional purity, carrying a very small percentage of unavailable material.

The Hazard Manufacturing Company, of Wilkes-Barre, Pa., has recently put in four miles of wire rope for the underground haulage system of one of the Pennsylvania anthracite collieries. The firm has recently taken up the manufacture of insulated copper wire, and built a large addition to its factory for this purpose.

A writer in a recent issue of a monumental journal asserts that granite fit for the best mon-

umental work is produced only at four points in this country—Barre, Vt.; Concord, N. H.; Quincy, Mass., and Westerly, R. I. Whatever regard the reader of that assertion might have for the writer who makes it, is overturned by the fact that he is speaking by his order-book, being a dealer in the granites that carry the names above given. Those granites are all most excellent. No question as to that, but "there are others" every whit as meritorious for monumental work. We cite, for instance, the granites furnished by Booth Bros. & Hurricane Isle Granite Co., of New York, N. Y., New London, Conn., and Rockland, Me. Nothing more superb than their "Connecticut white" for fine monuments, nor their Maine product for mausoleums and the larger memorials. This policy of disparaging other granites in the effort to exploit those the advertiser deals in, can not work any good to the industry. The truth about anything is not helped by derision of the other thing. "There's just as good fish in the sea as ever were caught."

THE CHISHOLM & MOORE MFG. CO.,

Cleveland, O., recently opened its new plant at the corner of Lake and Kirtland streets. It has been well employed for some months and increased its force on going into the new works. The demand for the company's differential chain hoists has kept up steadily. A successful development of the business is an electrically driven hoist, perfected recently. Loads of from three to ten tons are handled rapidly and economically. This is the first advance made by the company from hand power hoists, and promises to become an important feature of its business.

SITUATIONS WANTED.

Advertisements under this heading inserted for subscribers to STONE free of charge. Advertiser must send 25 cents to pay postage, if replies are to be addressed in care of STONE. Rate to non-subscribers, 10 cents per line each insertion.

WANTED SITUATION—Cut stone foreman desires position. Is capable of taking charge of all kinds of stone-cutting machinery. Have had 16 years' experience in cut stone business. Can give references from last employer, who has retired from business. Address FOREMAN, care of STONE.

SITUATION WANTED—By first class man as foreman or draughtsman on cut stone work. Has had large experience; can give A1 references; sober. Address P. A. J., care of STONE.

WANTED—Position; 16 years' experience as foreman and superintendent in general contract work, quarries and heavy masonry; expert on broken ashlar work. First-class references furnished. Address J. B. GORDON, Roscoe, New York.

WANTED—Situation as Superintendent or Manager quarrying and cutting stone, or either. Best references. Understand all details of the work; can read plans and handle men. CHAS. A. APPEL, Box, 5 A, Middletown, Conn.

ADVERTISER who is fully competent and experienced in his line, desires to arrange with good concern to represent the granite interest among dealers in Illinois, Michigan and Wisconsin on a commission basis. G. M., care STONE.

A SUPERINTENDENT OR MANAGER of monumental business. Accustomed to all classes of work, quarry, shed and office, good designer and modeler, etc. A. R., care STONE.

A STONECUTTER, 21 years old, desires a position as office assistant, draughtsman, or assistant foreman in a stoneyard. Understand plans; can lay out work, etc.; have had an education; salary no object; want experience. Address, B. E. HANSEN, 599 Pine Grove Ave., Chicago, Ill.

A MAN who is thoroughly acquainted with the Granite Business in all its details, having an experience of 15 years, wishes to correspond with reliable wholesale manufacturer or quarryman regarding a situation, either for road or office position, after January 1, 1899. Correspondence confidential. Address G. B., care of STONE.

TO SELL. TO BUY. TO EXCHANGE.

Advertisements inserted in this department for 15 cents per line each insertion.

MARBLE PROPERTY—Undeveloped. Fine gray and blue marble. Ideal water front and shipping point, mouth of Soo river on the great steamboat channel, 40 miles northeast of Mackinaw. Low freight, cheaply quarried. Rock bare, rising nicely from water's edge. Will give you a bargain on sale, lease or royalty. Your correspondence and investigation invited. W. B. HOUSE, De Tour, Mich.

FOR SALE—Blue Stone Quarry, located Summit, N. Y., 37 acres; also steam drill in good condition, separate or together; price low. For particulars address T. H. MAGILL, Troy, N. Y.

FOR SALE—Blue and Buff stone quarry, Bedford, Ind. Fourteen acres; two channelers, engine and boiler, derrick, drill, etc. Price low, sold together or separate. M. V. BROWN, 247 Warren Ave., Chicago.

FOR SALE CHEAP—One Ingersoll 3½ F. Drill, mounted on quarry bar for channeling. Little used and in good running order with some steels. \$200. Also, one 50-H. P. Tubular Boiler, with Blake steam feed pump; in good condition, \$200. Address NAPERVILLE STONE CO.

WANTED—To purchase one No. 5 Gates Crusher state the time it has been in use, and price on board cars. Must be in first-class condition. HUGH MURPHY, Omaha, Neb.

HELP WANTED.

Advertisements under this heading 10 cents per line each insertion.

WANTED—Three (3) thoroughly experienced men on stone planers. Must be well recommended. Apply to FRANK CARLUCCI, 724 Scranton St., Scranton, Pa.

Locations for Industries at Chicago.

Industries located on the line of The Belt Railway Co. of Chicago are afforded unequalled switching facilities and the advantage of connecting with all Chicago railroads. They have the benefit of competitive rates and an abundant supply of cars for shipments at all times. Parties contemplating the establishment of industries in the vicinity of Chicago are invited to communicate with the undersigned, who will promptly furnish full information in regard to locations, switching rates, car supply, etc. B. Thomas, Pres. & Gen. Mgr., Dearborn Station, Chicago.

D. W. Pratt

MACHINERY Engines, Boilers, Rock Drills, Stone Saws, Air Compressors, Steam Pumps, Pulsmeters, Hoisting Engines, Cableways, etc. Send for special Catalogue. 211 Lucas Ave., St. Louis, Mo.

NOTES FROM QUARRY AND SHOP.

THE NEW
PUBLIC L
ASTOR, L
TILDEN F

Gomer Williams is to open a slate quarry near the National Red Slate Company's quarry, at Middle Granville, N. Y.

Washington (D. C.) union granite cutters get \$3.60 a day.

Ed R. Knox and John A. Milligan have formed a co-partnership, under the firm name of Knox & Milligan, for the purpose of selling marble and granite gravestones, monuments, etc., at Hoopeston, Ill.

Hiram Dean's quarries at Marble Hill, Ind., have been leased to a Covington, Ky., firm. They will take out 12,000 yards of building stone.

A. & J. Pickel Stone Company, Chicago, was incorporated. Capital, \$2,500; stone; incorporators, Anton Pickel, Jacob Pickel, Charles Wern.

Cleveland, O.—A receiver has been appointed by Judge Neff for the Maxwell Blue Stone Company, which operates several quarries. W. J. Hart was appointed to conduct the affairs of the concern. The action was brought by Thomas and Albert McFarland, who have a claim against the company for \$1,557.25. Eugent Pernue, a mortgagee of the company, is made party defendant.

Vernon Foster has been appointed receiver for the Marble and Enamel Mosaic Company, 235 West Twenty-ninth street, New York City, in proceedings brought by the directors for the voluntary dissolution of the corporation. Mr. Foster is the president of the company.

Union City, Mich.—Fire destroyed a portion of the new plant of the Peerless Portland Cement Company. The dry kiln and mixing house were a total loss, with much valuable machinery. The principal portion of the plant was saved. The loss was \$40,000. One hundred men were thrown out of work. No insurance.

Catskill, N. Y.—The bluestone business this year has been practically at a standstill, owing to the poor market and low prices. Quarrymen in this section have nearly all stopped work in their quarries, not caring to take the chances of a better market in the spring.

Carl H. Rost, cashier of the Western Stone

Company, Chicago, is missing. The company claims to have found a shortage of \$5,000. The police are searching for the young man. Rost disappeared Sept. 30. His alleged stealings cover a period of less than one month. Rost, who is twenty-three years old, has been employed by the stone company about six years, and possessed the confidence of his employers. His bondsman was President M. B. Madden, who made good the shortage as soon as it was discovered. Rost comes from a good family. His father is superintendent of the Will county poor farm and his brother-in-law is a prominent Joliet physician. It is said that the young man's downfall is due to his fondness for horse racing and questionable society.

The Stockbridge Marble Company, of West Stockbridge, Mass., has been awarded the contract, under provisions of the act of Congress, for furnishing 10,000 headstones to mark the graves of United States soldiers. Since Congress first acted on the matter of providing headstones for unmarked graves, March 3, 1873, about 30,000 neglected soldiers have received this last good office of the government. The headstones are simple slabs of white marble, ten inches wide, four inches thick, and standing sixteen inches above ground. On the face will be inscribed the name of the soldier, rank, where he was other than a private, and the name of his company and regiment. Where the name of the soldier is unknown the inscription will be simply "U. S. Soldier." Since 1888 an average of 10,000 graves have been thus marked each year. The headstones will be transported and erected at the expense of the government over soldiers' unmarked graves in any national, city, or village cemetery, upon application to the War Department by relative or any one interested in the dead soldier.

From Bayport, Mich., comes the information that the quarries are handicapped in their operations by lack of men. The company is paying \$1.35 per day, with board at \$3.15 per week, and yet cannot secure help enough. This is the plant that was written up in August Stone.

Wm. N. Matthews, General Manager of the Perry, Matthews, Buskirk Stone Company, Bedford, Ind., was nominated by the Democrats as their candidate for state senator from the district composed of Lawrence, Orange, and Martin, has decided not to make the race.

Salt Lake City, Utah.—The Hobbie Creek Marble Company, which was incorporated recently, on a fine marble quarry in Hobbie creek, in Utah county, is making arrangements for the extensive operation of this property, and it should not be long before it is in a position to supply the market with some of the finest product in this line ever offered in competition with stone dealers on this continent. The Hobbie creek marble is a fossilized stone of a deep chocolate color, the texture of which is exceedingly fine, while it is susceptible of a beautiful finish and polish, and can be taken out in large slabs of any required thickness or size. Hon. Allen G. Campbell, the president of the company, states that this is the largest proposition of this character he ever saw, and he is satisfied that the marble industry will ere long assume mammoth proportions in Utah.

Bowling Green, O.—Herman Smith is dead, as the result of a premature explosion of a can of blasting powder. Smith was an employe of the Lime City Company's quarries. Instead of opening the can of powder with the usual can opener, Smith attempted to pry open the package by driving a spike in the top. The result was an explosion, which threw him some distance and set his clothes on fire. Internal injuries and the result of burns caused the young man's death.

Red Scotch granite from Peterhead is to be employed for the national monument which the Transvaal is to erect at Pretoria to commemorate the repulse of Jameson's raid, and an Aberdeen firm has been found ready to provide the granite and execute the work. The Boer's sense of humor seems stronger than the Scotchman's.

John D. Rockefeller has let the contract for largest monolith ever quarried in the United States. It will mark the family lot of John D. Rockefeller in Lakeview Cemetery, Cleveland, O. The monument will be studiously plain, but it will attract attention from its mammoth size. The monument will be fifty-five feet high from the base to the tip. It will be sixteen feet square at the base. It will be located on the same ridge as the Garfield Memorial.

Among the stone exhibits from Alamogordo to the Albuquerque (New Mexico) fair is a piece of first-class onyx weighing ninety-two pounds, from the mine of A. A. and W. L. Breece and W. C. Alexander, in Alamo cañon; also some fine pieces of lithographing stone and jet black marble from the same locality. The onyx, lithographing stone, and marble are within nine miles of Alamogordo and the supply is inexhaustible.—Independent Democrat.

Butler, O.—Land has been leased by the Buckeye Stone Company, of Lima, which is opening a quarry, and will furnish stone for building purposes. The B. & O. R. R. will run a siding to the quarry.

Columbia Marble Company was recently incorporated, for the purpose of handling marble quarries on an extensive scale. Principal place of business, San Francisco, Cal. Directors—A. Poniatowski, T. S. Bullock, Hall McAllister, William Angus and C. H. Ellison, San Francisco. Capital stock, \$100,000, of which \$25 has been subscribed.

Greensburg, Pa.—Allshouse & Beck, stone contractors, made an assignment Sept. 29. The firm is composed of Josiah Allshouse and Leonard Beck. They claim assets to the extent of \$75,000, with liabilities of about \$45,000.

W. H. Houghtlin, of Jerseyville, Ill., has sold his interest in the Jerseyville Marble Works to R. L. Hill and J. C. Reintges.

St. Cloud, Minn.—The Rockville Granite Company property, including the polishing plant and all other machinery, and two acres of ground, upon which the buildings are located, was sold at auction Sept. 30, at Rockville. The purchaser was Henry Alexander, one of the company members, who will continue the business under the company name. The consideration was \$3,400. The company has a lease of the quarries, which belong to O. Tenny, of this city.

Albany, Ill.—Levi Morrow will open a new stone quarry for the use of the government in its river improvements.

The Canadian Pacific R. R. company's cement works at Victoria, B. C., it is reported, are to be increased by the addition of a plant, at an enormous expense, capable of turning out one million barrels per year. At present the works manufacture twelve thousand barrels, of which seven thousand are used in construction work on the Canadian Pacific railroad. The idea in increasing the plant is to capture the entire market on the coast outside of San Francisco. It is understood that all the raw material used in the manufacture of cement can be secured in British Columbia, and the cement manufactured is equal in quality to Portland cement and can be placed on the market much cheaper, the only difficulty heretofore experienced in selling the British Columbia article being an inadequate supply.

Charlottesville, Va.—A party of capitalists, with Mr. Gammon, of Norfolk, as the head, are preparing to open the marble quarry situated on the farm of Howell Lewis, twenty miles south of this city. First-class machinery is being put in and the quarry will be worked to its full capacity. The marble is of excellent quality.

The Portland Cement Company, of Utah, has leased oolitic limestone lands about Bedford, Ind., and will erect a \$125,000 plant. State Geologist Blatchley and the company's representatives have made extensive experiments, showing that Bedford stone and Jackson county shale make better cement than Portland.

*Mr. Thomas A. Edison
examines a "New In-
gersoll" Rock Drill.*

*An order for 8 additional Drills
is the result. Making 15 in all,
for his Works at Edison, N. J.*



THE "NEW INGERSOLL"

(WRITE FOR CIRCULAR.)

Air Compressors—Rock Drills—Coal Cutters

The Pohlé Air Lift Pump.

The Ingersoll-Sergeant Drill Co.,

HAVEMEYER BUILDING, N. Y.

Yaquina (Oregon) Stone Company, to acquire and develop sandstone and granite rock quarries; \$10,000; Edwin Stone, A. Rochester and R. A. Bensall, Albany.

Milwaukee, Wis.—Dissolution of the articles of incorporation of the Cream City Cement Company have been filed. George Brumder was president and Frank Dankoehler secretary.

Stone-carvers' Society, Chicago; incorporators, Joseph Richter, John Wilson and Jean Anderson.

Chicago—Gottfried Sindlinger, a stone contractor at 549 Morgan street, was found dead on a bench in Lake park, Milwaukee, October 1. In his right temple was a bullet hole.

Louis Yost, one of the oldest monument builders in New Jersey, and proprietor of the Belleville Avenue Granite Works, died suddenly in Bloomfield, September 27. He was seventy-two years old, and leaves a large family.

William H. Williams, the wealthy slate operator, of Slatington, Pa., who was thrown from his carriage while driving, died September 12. Williams was 53 years old, and leaves a widow and six children.

Arthur Strunk, of the firm of Strunk Bros., operators of the Washington Slate Quarry, at Bangor, Pa., deceased.

Henry A. Cornwall, of Portland, Conn., manager of the Middlesex Quarry Company, died in a sanitarium at Providence, of paralysis of the stomach, aged 55 years. He was a war veteran. He represented Portland in the Legislature of 1890. He was a director in the First National Bank of Portland, and a trustee of the Freestone Savings Bank.

New York.—Execution against Bird & Parr, 503 to 509 East Eightieth street, for \$1,021, in favor of Meeker & Co., for coal. The partners are James R. Bird and Mrs. Arietta Parr. They are also in the contracting and bluestone business at Tarrytown, N. Y., where Mr. Bird claimed to be worth \$170,000, principally in real estate, mortgaged for \$70,000.

Milwaukee, Wis.—The Monarch stone quarry, west of the city, was sold at auction by the sheriff, September 26, for \$125,000, to the Monarch Stone Company. This sale was the outgrowth of litigation instituted over a year ago by Charles O. Manegold, Louise Manegold, George Schweickhart, Sr., and G. Schweickhart, Jr., against the Monarch Stone Quarry Company. They secured a judgment which was docketed May 18, 1897, for \$169,317.49.

The stone-cutters' union, of St. Paul, Minn., has voted to issue an appeal to architects and business men, petitioning their support in a movement to have all stone used in the city cut and dressed by home labor. The stone-

cutters claim most of the stone used in the city is prepared in smaller towns at wages much below the local union scale. The action of the stone-cutters' union was indorsed by the trades and labor assembly.

Lawrence Bruce, owner of the Bruce sandstone quarries north of Warrensburg, Mo., recently closed a contract providing for the stripping of a tract of ground 160x110 feet just south of the old quarry. A big quarry is to be opened there next spring by the Bruce company to furnish the product for next year's trade.

Fine white marble deposits have been uncovered in La Luz cañon, New Mexico.

Montpelier, Vt.—The Robinson-Moran Granite Company is opening a quarry which has been leased from Hatch Bros. An addition will be built on the shed the company now occupies and more men added.

Portsmouth, O.—Guilford Marr, Secretary Rardon Stone Company, is missing.

The shipments of granite from the several points in Quincy, Mass., in August, were 21,224,041 pounds, an increase of 12,431,464 pounds over July, and 9,582,444 pounds over August of last year. Business is much better.

Catskill, N. Y.—The Acra stone quarries, which have been idle for fifteen years, are to be reopened. Contracts have been made for 250,000 feet of flagging.

Cobleskill, N. Y.—Whalen, Ross & Co., of New York, have leased the Wieting-Reilly quarries north of this village, and will open in a short time, employing over one hundred men to get out the stone. The new firm will replace the narrow gauge road with the standard gauge of four feet eight inches, to allow a train to be run to the quarries.

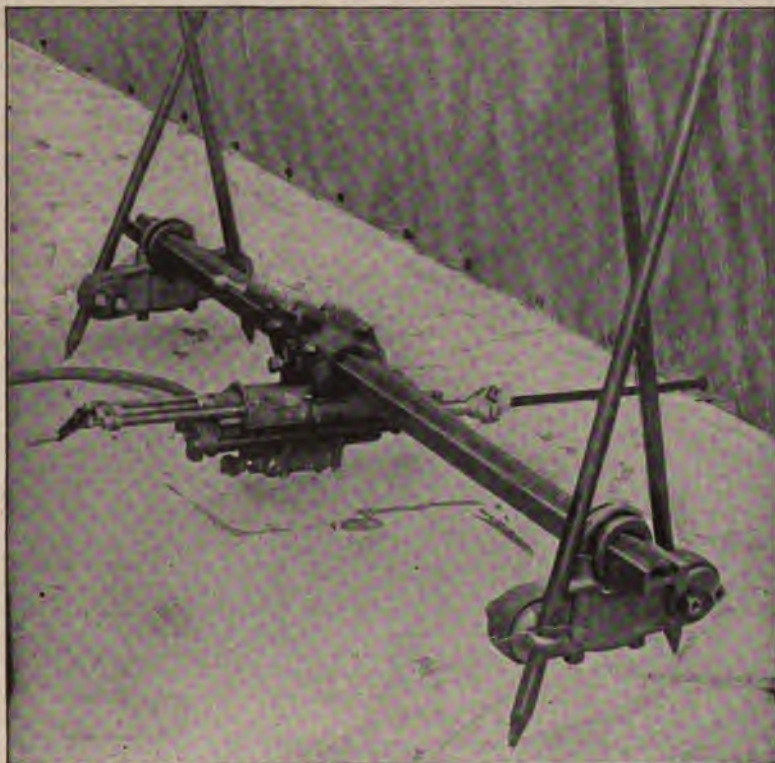
Bozeman, Mont.—A new marble and stone-cutting establishment was started recently by Messrs. Scott & Nelson.

Columbus, O.—The entire property of Taylor, Beall & Co., which has been operating the quarry near Columbus, has been purchased by the Columbus Stone Company. This company was incorporated September 24 with a capital stock of \$60,000, the directors being J. H. King, S. Casparis, W. O. Taylor, R. M. Gilbert and D. W. Evans. S. Casparis has been elected president and treasurer, W. O. Taylor, vice president and superintendent, and D. W. Evans, secretary. The quarries will be equipped to furnish building stone on a larger scale than heretofore, with modern improvements. Brick and cement works are contemplated later on.

The Hillside quarry at Monson, Me., which has been idle for the past three years, is to be started up at once. The property is now owned by the Monson Consolidated Slate Company. They will employ a force of ten men.

Sullivan Quarry Bars
Sullivan Gadders
Sullivan Rock Drills.

RAPID. STRONG. CONVENIENT.



THE SULLIVAN QUARRY BAR.

Channeling Machines for All Kinds of Work.

Contractors for

Prospecting Quarry Lands with Core Drills.

SULLIVAN MACHINERY CO.

Main Office, 54 to 60 N. Clinton St., CHICAGO.

Eastern Office & Works, CLAREMONT, N. J.

339 Fifth Ave., PITTSBURGH, PA. 332 Seventeenth St., DENVER, COL.

Please mention **STONE** when you write to advertisers

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There is good prospect of the opening of an important industry in the town of Altona, near the village of West Chazy, N. Y. A large deposit of granite has been discovered there. The rock has been critically examined by dealers in Barre granite, who have pronounced it of superior quality. The visitors have purchased forty-five acres of land, and it is said have secured options on several other parcels in the neighborhood. It is understood to be their intention to organize a company and to begin work this winter.

New Albany, Ind.—The Blue Rock Cement Company, composed of capitalists from New Albany and Jeffersonville, was organized Aug. 31, with a capital stock of \$75,000. It will build a mill near Housedale, on the Pennsylvania road, nine miles north of this city.

Gadsden, Ala.—Fred Landt, of Anniston, is placing the necessary machinery for the development of rock quarries near Gadsden, and will employ about twenty-five operatives.

Savanna, Ill.—C. C. McGregor will open a quarry at Dark Chute where he expects to take out 5,000 to 10,000 yards of rock to be used in the government work of putting in dams and shore protections.

Salina, Kan.—Geo. T. Woolley, formerly of this city, is now located at Mulvane, as superintendent of the American Cement Plaster Company. He says they have a large deposit of fine material and will have a fine mill built, containing the best up-to-date machinery.

Asbury Park, N. J.—L. M. Taylor has not disposed of his stone business, but he has sold the lime, cement and plaster trade to Thos. T. Gravatt, but will manage the stone department as usual.

Joliet, Ill.—Conrad Braun has gone into partnership with Henry C. Frederick a dealer in marble and granite tomb stones at Peotone.

Baltimore, Md.—Ferdinand C. Dugan, trustee, has sold the stone quarry on Falls road, near Glen Edwards avenue, to Ellen G. Garrettson, for \$1,575.

Westerly, R. I.—Negotiations have been in progress looking to the consolidation of the Dalbeattie Granite Works and the Smith Granite Works, two of the largest granite firms in this town. It is proposed to found a stock company. The final plans have not yet been consummated.

Quincy, Mass.—The granite firm of McDonald & Cook has dissolved partnership. Mr. McDonnell will continue the business.

Petersburg, Va.—The Petersburg Granite Company has passed into the hands of a receiver—Mr. Robert Gilliam. Work at the quarry in Dinwiddie county has been suspended for some time, but the reason assigned was that the company had a large contract in the north,

and the force was needed there for its completion. A month or so ago, Mr. Dibble, the president, had expressed the hope that the quarry would be reopened soon, but that hope has proved groundless. There is a first mortgage on the property which, together with the rental lien, will more than absorb proceeds of the sale, and from present appearances bondholders and other creditors have no encouraging prospects.

Riverside, Cal.—J. F. Conroy has begun suit against the Declez Granite Company, et al., to enforce payment of a promissory note for \$6,000.

The Passaic City (N. J.) Brownstone Company. It is organized to quarry and deal in brown and all other kinds of stone. The incorporators are William F. Gaston, Charles M. Howe and Robert D. Kent. The company is capitalized at \$100,000 and begins business with \$1,000 paid in.

The Maine Granite Company has recorded its certificate of incorporation. The concern will deal in stone and do a business as street paving contractors. Its main office will be at 39 Halsted street, East Orange, N. J. The capital stock of the organization is placed at \$50,000, of which \$2,000 is paid in. The incorporators are Charles H. Moore and Fannie C. Moore, East Orange, and William S. Wallace, of New York.

Nelan Cut Stone Company, Chicago, Ill.; capital stock, \$2,500; incorporators, James Nelan, Henry M. Feinberg and Myer Lesser.

Under an execution against the Kingston, N. Y., Limestone Company, in favor of Oakes Terrill, the company's president, for \$5,040, sheriff sold the quarries. This did not cover all the property belonging to the company. The right, title and interest of the company were bought in by President Terrill's lawyer, Mr. Robinson, of New York, for \$255.

New York City—James F. Dolan, dealer in granite and bluestone, at 412 to 424 East One-Hundred-and-Fifth street, confessed judgment for \$11,722, in favor of John J. Hopper, for borrowed money, and an execution was issued to a deputy sheriff. Mr. Dolan has been in business since 1879, and a few years ago was said to be worth over \$100,000. He has quarries in New Hampshire. In January last he gave a chattel mortgage for \$12,000 to Mr. Hopper on derricks, etc.

Bloomington, Ind.—The first annual meeting of the Indiana Stone Road Company was held September 21. The following were elected directors: Samuel Thomas, E. R. Thomas, of New York; G. B. Shaw, C. H. Rockwell, B. E. Taylor, E. C. Field, of Chicago; W. W. Wicks, of Bloomington. Gilbert B. Shaw, of Chicago, was elected President. All of them, except Taylor, Rockwell and Wicks, are directors of the Monon. Rockwell is Traffic Manager of the road and Taylor is Purchasing Agent.

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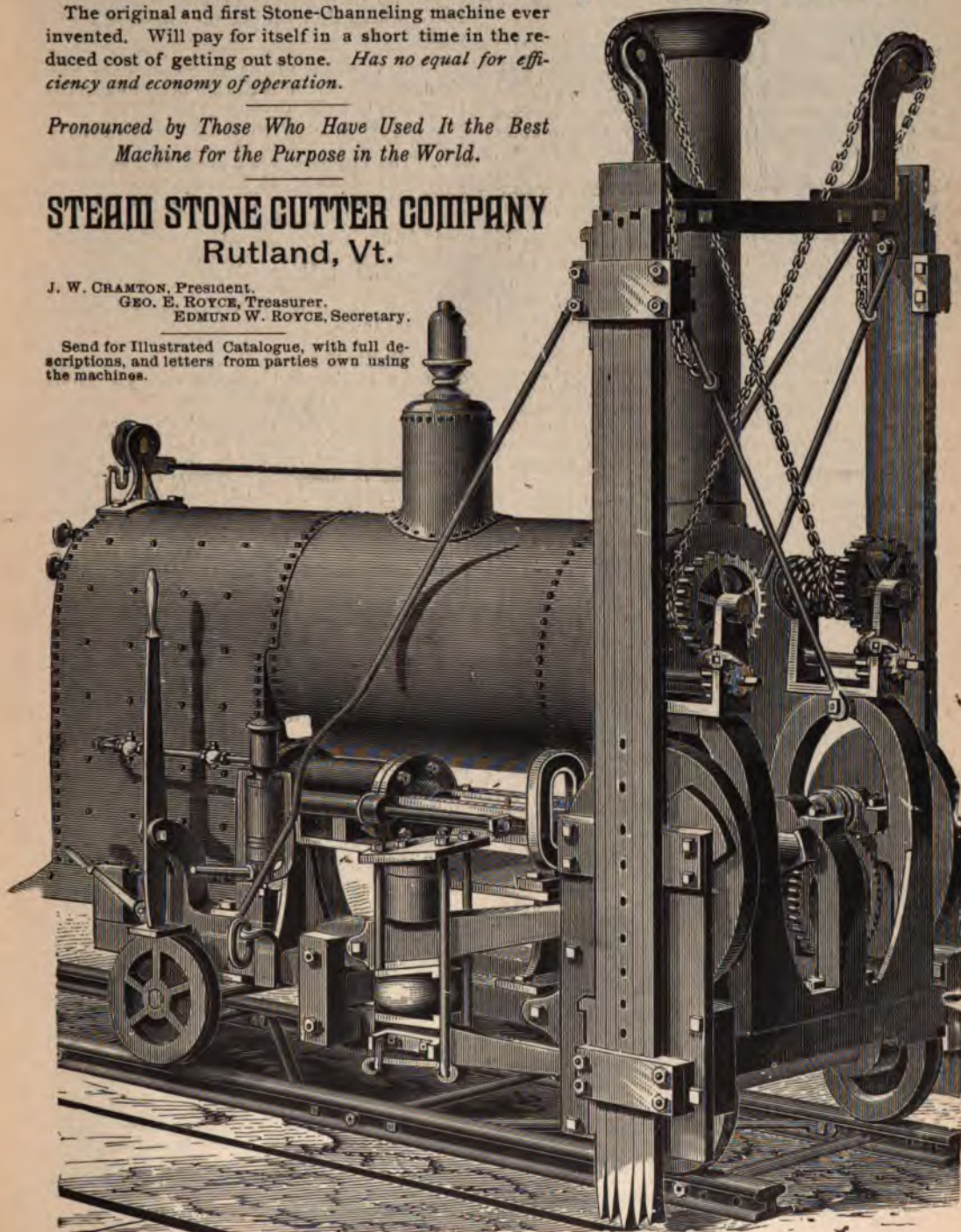
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Hagerstown, Md.—The Potomac Cement Works, near Shepardstown, have been sold to H. W. Blunt, Jr., of Washington, D. C. The plant comprises thirteen acres of land, brick cement factory, kilns, and Potomac river right.

New York City.—An attachment for \$10,414 has been obtained against the Springfield Quarrying, Mining and Construction Company, with an office at 44 Broadway, and quarry at Oakland, Orange county, N. Y., in favor of the Produce Exchange Trust Company, on two notes of the company to the Standard National Bank, which were turned over to the Produce Exchange Trust Company. The notes were indorsed by Walter J. Roberts. The attachment was granted on the ground that it is a West Virginia corporation. It was incorporated in 1894, with a capital stock of \$300,000, and a few months ago it was said that the company was being absorbed by a new company, which was consolidating a number of concerns in the same line.

The Stanstead (Ont.) Journal says: "The assets of the Moir Granite Company, including the real estate near Beebe Plain, quarries and railway, were knocked down under the sheriff's hammer at Stanstead. The property was bid in by the Eastern Townships Bank for nominal sum to cover costs and judgment. The stockholders were perfectly able to pay off their mortgage and liabilities, but they regarded it as a losing game in any case, and did not care to squander any more money. They have lost every cent invested."

Columbia, Pa.—The court has made a decree dissolving the corporation known as the Gordonville Steam Quarrying and Crushing Company.

Eau Claire, Wis.—The monument business formerly carried on by R. K. Wilkie, will hereafter be conducted by his wife, with Thomas Wilkie, Sr., in charge of the shop.

Lynnville, Tenn.—Bugg & Walker, dealers in monuments, wire, and iron fencing, have dissolved partnership, R. M. Bugg retiring. The business will in future be conducted by T. M. Walker.

Wapaca, Wis.—Arrangements have been completed during the past few weeks by which Ripley Bros., of Oshkosh and Milwaukee, assume entire control of the Waupaca granite quarry. The Ripleys have means and when they get ready they will push the enterprise for all there is in it.

The New Brunswick Marble Company, at Pierre, S. D., with a capital of \$150,000. Incorporators: E. L. Squire, Jerry Maroune, New York; Phil Smith, Sioux Falls.

Amherstburg, Ont.—The Chicago Quarry Company, it is said, will soon take hold of the old quarry and give it a boom. The stone is of fine quality, and the new company expects to

find a much larger market for it in western Canadian cities.

Northfield, Vt.—H. D. Phillips & Co. have closed up their granite business and moved to Barre, where they believe they have better facilities.

Barre, Vt.—One of the largest granite firm changes in Barre was consummated when the large firm of C. E. Tayntor & Co., of that city, sold out to William E. Calder, of the firm of Burley & Calder. The price is said to be \$17,000. The business was owned by Charles E. Tayntor and Rufus N. Tayntor, two brothers, of Brooklyn, N. Y. It is rumored that the Tayntor brothers will erect in the city in the near future a large granite plant for the sole purpose of getting out large work, such as mansoleums and the like.

Wm. W. Groat & Co. have opened a shop in Baldwin, Iowa.

Fort Scott, Kan.—D. P. Bruce & Co. have opened a marble and granite yard on Third street, opposite the court house.

Milwaukee, Wis.—The Monarch Stone Company. The incorporators are: F. J. Kipp, J. W. Bingham and William T. Durand. The capital stock is placed at \$75,000, divided into shares of \$10 each.

The Lemont Limestone Company, Chicago, with a capital stock of \$10,000. Its incorporators are S. B. Brier, J. G. Bodenschatz and E. H. Brown.

Articles of incorporation of the Marshalltown (Ia.) Stone Company has been filed with county auditor. The incorporators are: F. G. Pierce, C. H. E. Boardman, Nellie Pierce and B. A. E. Boardman, and the company will operate the old Nicholson and McNeely stone quarries at Rockton, east of Marshalltown. The capital stock is \$25,000, of which \$10,000 must be paid in before the commencement of business. Messrs. Pierce and Boardman have for some time held an option on the property and will purchase outright the land on which the quarries are located. F. G. Pierce is president and C. H. E. Boardman secretary of the company.

Sault Ste Marie, Mich.—The Union Carbide Company is making tests of the limestone found in this county with a view to quarrying its own limestone for use in the manufacture of carbide in its enormous plant to be erected on the water power canal. At present the company is getting its supply from Petoskey and Alpena, but when the big plant starts up it is desired to get the supply from nearer the Soo. When installed the works will require 175 tons of limestone per day.

Beaver, Pa.—A. E. Bruce has purchased the Eckles red rock stone quarry, on the E. & P. R. R., seven miles south of New Castle, Pa., and leased it to a Pittsburg firm. The stone is of a superior quality.



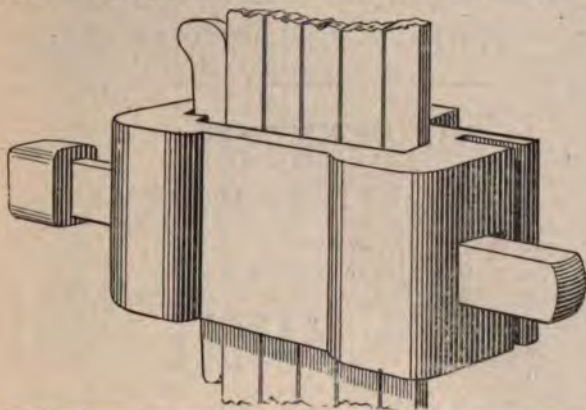
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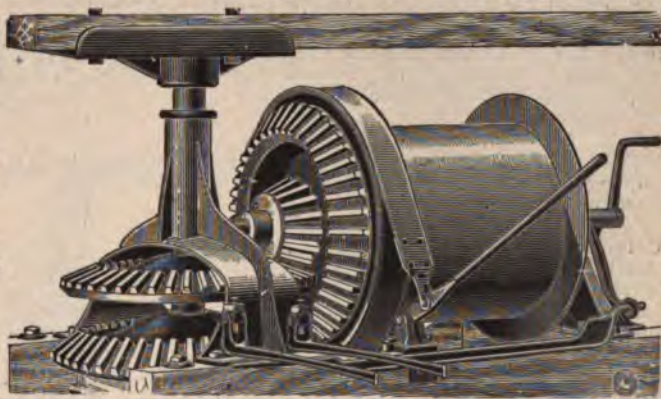
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Boston, Sept. 17.—Proposals were opened today by Quartermaster Hyde for the contract to supply the government with 10,000 gravestones, this number being subject to an increase or a decrease of 20 per cent. There were but four bidders. D. Borgia, of New York City, made a bid of \$5 per stone, supplying white Italian marble; the Stockbridge Marble Company, of West Stockbridge, Mass., offered white marble at \$1.35 a stone; Norcross Bros., of Worcester, offered to supply stones like the sample offered at \$3. The fourth and last bid opened was from the Vermont Marble Company, of Proctor, Vt. This firm would supply stones like the sample at \$1.52. The last-named firm had the contract last year.

Granville, N. Y.—The slate quarries which were closed by the Granville manufacturers a few weeks ago, were opened Sept. 1. The large number of employees who have been idle are now having steady work. There is now a great demand for slate, and at no time has the slate industry had a better prospect than at present.

New York City.—James F. Dolan, dealer in granite and bluestone, Nos. 412-424 East One Hundred and Twenty-fifth street, confessed judgment for \$11,722, in favor of John J. Hopper, for borrowed money, and execution was issued to deputy sheriff.

Kankakee, Ill.—Some unknown person tried to blow up the stone-crushing plant of Donald Sinclair. A few sticks of dynamite wrecked a pump. The watchman had left the scene of the explosion about a minute previous, and saw nothing suspicious. Mr. Sinclair has had no trouble with his men.

Quanah, Tex., Sept. 14.—The Salina Cement Company's entire plant burned this morning. Loss about \$4,000; no insurance.

Columbus, O.—Taylor, Beall & Co., owners of Marble Cliff quarries, may go into the hands of a receiver. It is claimed that there has been an effort to dissolve the partnership which has resulted in a disagreement culminating in two suits being filed for a receiver. James P. Beall made application to Judge Badger for a receiver and the judge appointed Mr. Howard Park, but when they appeared in the clerk's office to have their petition filed they were surprised to find that William J. Keefer, a member of the firm, had filed a suit very similar to theirs, which they had taken before Judge Williams. When this fact was learned the appointment of Mr. Park was not confirmed and the two judges will probably determine who shall take charge of the company's affairs. The company has property worth about \$90,000 and they were making money. Mr. Taylor was ready to buy the others out and there was really no occasion for the suits for a receiver.

Davidson Bros. Marble Company, Chicago, Ill., certified to an increase of capital stock from \$50,000 to \$75,000.

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BOOKS AND PERIODICALS.

The complete novel in the October issue of Lippincott's is "Confessions of an Aide-de-Camp," by Captain F. A. Mitchel. It is a rattling tale of the civil war, and the heroine and hero (especially the heroine) pass through some surprising adventures. Other stories are "Tish's Triumph" and "Grandma's Diamond." The latter is by R. L. Olbar.

Appleton's Popular Science Monthly for October contains an article by Edward Atkinson, entitled, "The Evolution of High Wages from Low Cost of Labor." He points out that in every branch of industry there has been a progressive advance in the rate of wages, and that this advance has been accompanied by, and is in fact a consequence of, a general decline in the prices of nearly all products.

Beginning with the next (November) number, Frank Leslie's Popular Monthly will be changed in form and dress. Its price will be reduced to ten cents per copy, one dollar per annum. Mrs. Frank Leslie, whose association with Frank Leslie's Popular Monthly has been the chief factor in its success and fame, now resumes direct editorial control of the magazine after three years' rest and sojourn abroad. This congenial work will occupy Mrs. Leslie's exclusive attention. Under her skilled and sympathetic guidance, the changes inaugurated in the long-time favorite illustrated family magazine will be in the line of development of the popular pictorial and literary features which have characterized it heretofore. At the same time various novelties will be introduced. The tone and policy will be more than ever distinctively American, in the new, broad, "imperialistic" sense.

Lovers of beautiful architecture—and who is not—will find pleasure in the initial article in the October Chautauquan, upon "The Cathedrals of England." The ten illustrations show exceptionally good views of Canterbury, Winchester, Durham, Salisbury, and Ely, and the text accompanying them, very entertainingly written by S. Parkes Cadman, points out their distinguishing features and gives just enough of the history of each to whet the appetite. A second article in the November number will complete the series.

PAMPHLETS AND CATALOGUES RECEIVED.

From Bay Port, Mich., Quarries, reprint in pamphlet form of article that appeared in August *STONE* descriptive of the plant of this company, with addition of scientific report of Prof. J. B. Johnson, of Washington University, St. Louis, who made elementary analysis and physical tests of the different products of these quarries.

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From Lincoln Iron Works, Rutland, Vt., Circular No. 82, descriptive of the stone-sawing machines manufactured by this company. A valuable supplement to their general catalogue.

From Sullivan Machinery Co., of Chicago, Catalogue No. 32, descriptive of coal mining machinery manufactured by this company; also special descriptions of the Sullivan rock and core drills. Finely illustrated, neatly bound and clearly printed.

From Curtis & Co. Manufacturing Company, St. Louis, a very interesting and elaborate brochure in which is set forth the merits of the pneumatic appliances manufactured by it. These embrace air compressors for shop purposes; air hoists, vertical and horizontal; pneumatic traveling cranes, air reservoirs, and a line of specialties applicable to this class of machinery. All illustrated in half tone and printed on heavy plate paper, partly in colored borders. A choice addition to anybody's collection of catalogues.

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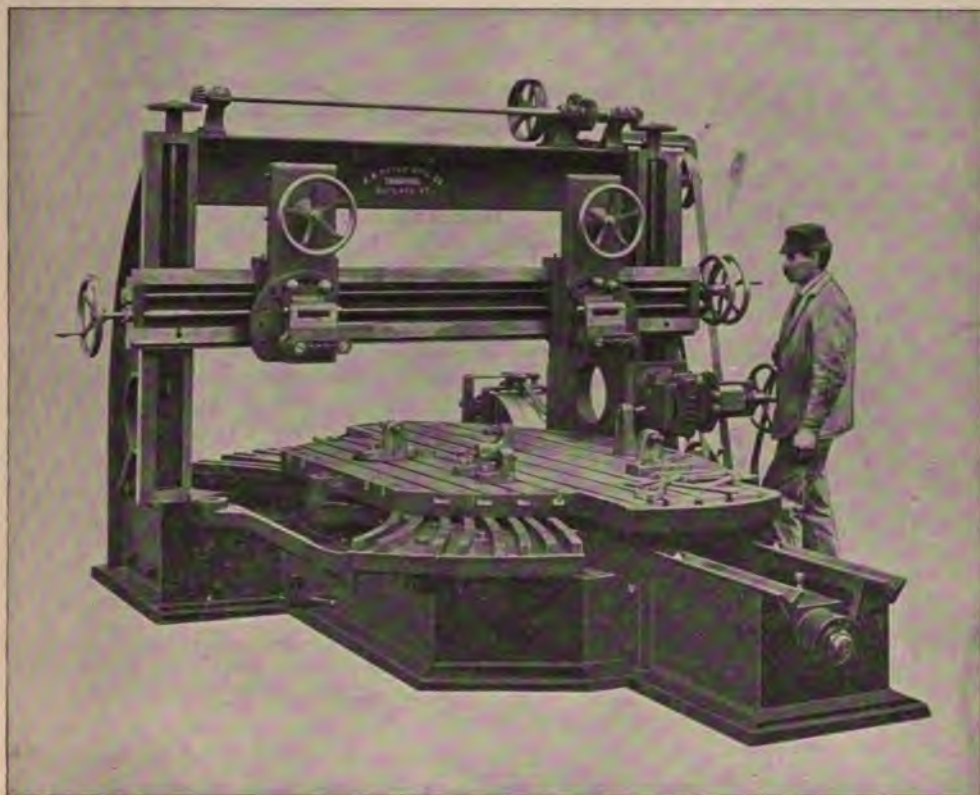
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CONTRACT NEWS.

McKeesport, Pa.—The school board is arranging to issue \$150,000 in bonds for the erection of a High School building.

Cincinnati, O.—The directors of the University of Cincinnati have received \$60,000 for the erection of a south wing to the University.

Greensburg, Ind.—It has been decided to locate the I. O. O. F. Home at Greensburg. The Society has now on hand \$30,000.

Adel, Iowa.—The proposition to issue \$45,000 in bonds for the erection of a court house will be voted upon at the November election. C. R. Lyon, auditor.

Dayton, O.—The city authorities agreed upon plans for a new \$500,000 union railway station here. The plans submitted by Elsner & Anderson, of the "Big Four," Cincinnati, were selected. The railway magnates hold a meeting in Cincinnati to discuss and adopt plans.

Kansas City, Mo.—The B'nai Jehudah congregation has decided to build a new temple. Committees were appointed to take charge of the plans.

Keyser, W. Va.—Frank P. Milburn, Charlotte, N. Y., is preparing plans for a \$10,000 jail to be erected at Keyser, W. Va. Bids will be received February 1.

Des Moines, Iowa.—The county board voted to submit to the people the proposition to build a \$400,000 court house.

Lewiston, Pa.—The M. E. Society will receive bids October 30 for building a \$30,000 church. W. O. Weaver & Son, Harrisburg, Pa., architects.

St. Louis, Mo.—Barnett, Hayes & Barnett, architects, will receive bids October 25 for a \$150,000 theater building, to be erected by the St. Louis Realty and Amusement Company.

Springfield, O.—An ordinance is before the council to authorize the proposition to issue \$20,000 in bonds to build a city prison, to be submitted to a vote of the people.

\$15,000; 48x56; one story and basement; brick, stone, pressed brick, stone trimmings, slate roofs, sidewalks.

St. Louis, Mo.—The directors of the public library held a meeting September 23 to consider the needs of the library for more commodious quarters. The board has already secured a site for the proposed building. Estimates are made that it will require \$2,000,000 to erect and furnish the new building.

Augusta, Ga.—The representatives of the Georgia roads agreed to build a depot. Plans and specifications will be prepared immediately. Thomas K. Scott, general manager, Augusta.

Spencer, Iowa.—The Clay county voters will vote in November on the question of issuing \$40,000 court house bonds.

Port Clinton, O.—Sealed proposals will be received from the 30th day of September to the 1st day of November, for furnishing the materials and performing the necessary labor required for the construction, erection and completion of a new court house for Ottawa county. E. A. Powers, auditor of Ottawa county, Ohio.


Richmond, Va.—The congregation of Kene-seth Israel is taking first steps toward building a new synagogue. H. Fisher, president.

Decatur, Ill.—Joseph Ramsey, Jr., general manager of the Wabash road, St. Louis, is conferring with the council in regard to the erection of the depot by the Wabash and Illinois Central railways. The building will be 120x60. The railroad officials now state that the depot will cost about \$100,000.

Trinidad, Col.—J. H. Hurley, Las Vegas, N. M., superintendent of the Santa Fe R. R., announces a depot for Trinidad. The building is to be of stone, one story high, 120 feet in length, and of Queen Anne style of architecture. It will be erected in the early spring. The Denver & Rio Grande people are also making arrangements to erect a new depot at this place.

Springfield, Mo.—The St. Louis & San Francisco Railway proposes to build a \$40,000 hospital at Springfield, provided a suitable site is donated. L. D. Button, division superintendent, Springfield, Mo.

Manteno, Ill.—Church. St. Joseph's Roman Catholic Society, owners. Harvey Wright, Chicago, architect. Contracts not let. Cost,



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XX

Mt. Carmel, Ill.—All bids for the erection of the M. E. church were rejected. New bids will be received October 3. R. K. Sttees, secretary.

Louisville, Ky.—Plans have been prepared for a church to be erected by the St. Boniface Catholic congregation. Estimated cost, \$75,000. Work will be commenced in the early spring.

Sharon, Pa.—The Buhl Steel Company has decided to issue bonds to the amount of \$250,000, for the purpose of enlarging the works.

Columbus, O.—The Franklin County Liquor League proposes to organize a stock company to erect a brewery to be operated on the cooperative plan. Fred Zeigler, Henry Weisbecker and Henry Seibert, committee.

Kansas City, Mo.—Plans have been prepared by J. C. Williams, this city, for a proposed opera house here. Estimated cost, \$100,000.

Tuscola, Ill.—R. Z. Gill, of Urbana, is preparing plans for a \$20,000 hotel to be erected here.

Kayser, W. Va.—Frank P. Hilburn has prepared plans for a new jail building to be erected in the spring. Estimated cost, \$10,000.

Washington, D. C.—The diocese of Washington has purchased a tract of land for \$245,000, for the erection of a Cathedral school for girls, and other diocese buildings.

Circleville, O.—The Presbyterian Society will build a \$25,000 church. Plans have been prepared by Stribling & Fox, Columbus, O.

Ottumwa, Iowa.—Press report states that a \$75,000 brewery plant will be erected at Ottumwa.

Chattanooga, Tenn.—Plans are being prepared for a building to be erected by the News. Contracts will be let at once. The building will be of stone and brick. Chattanooga News Publishing Co., owner.

Elkhart, Ind.—Wing & Muhuring, of Fort Wayne, have prepared plans for a three-story brick and stone club house. A large part of the expense of building the club house will be met by H. B. Buckley.

Eldorado, Kan.—The Santa Fe will build a \$60,000 stone depot at Eldorado. J. J. Pray, general manager, Topeka, Kan.

Manteno, Ill.—The St. Joseph Catholic Society has accepted plans prepared by Harvey Wright, 226 La Salle street, Chicago, for the erection of a \$15,000 church. Rev. C. H. Olnard, rector.

Springfield, O.—The Y. M. C. A. has under consideration the erection of a new building.

New Orleans, La.—Plans have been prepared by Theodore Brune for the brewery to be erected by the Columbia Brewing Company. The building will be completed by March, 1899.

Garner, Iowa.—Contractors are hereby notified that the Board of Supervisors will receive sealed bids up to and including November 14, for the erection of a new court house in Garner, Iowa. Plans and specifications may now be seen at the office of F. W. Kinney, at Austin, Minn. All bids to be accompanied by a certified check for \$1,000. All other terms and conditions upon which said contract will be let may be obtained of the county auditor of said county at his office in Garner on and after November 1. H. W. Reed, county auditor.

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xxii

Sheldon, Iowa.—The M. E. Society has received plans for the erection of a \$10,000 church. The society has \$8,000 of the amount on hand.

Vinton, Iowa.—The question of building a \$75,000 court house will be submitted to the citizens at the fall election.

Niagara, N. Y.—Architect A. A. Post, of Buffalo, has made plans for a chapel for the Catholic Niagara University at Niagara Falls. It will be of stone, with slate roof, and will have marble altar. The cost will be about \$20,000.

Buckhamon, W. Va.—An election will be held to vote on the question of issuing \$40,000 in bonds for the erection of a court house.

Cleveland, O.—Dugman & Uhlreth have prepared plans for a \$60,000 church to be erected by the Catholic Society. Rev. Francis Wetterlich, 2136 Superior street, pastor.

Cascade, Iowa.—The St. Martin's Catholic Society is taking steps toward the erection of a \$20,000 church. Rev. L. Roche, pastor.

Hammond, Ind.—Press report states that the Dealers' Distilling Co. has partially closed negotiations for the erection of a distillery here to cost \$1,000,000. Work on the buildings will probably begin this fall.

Toledo, O.—Miss Sarah J. Clark has donated a lot and \$10,000 toward building a Christian Science church. The corner stone has been laid.

Savannah, Ga.—Plans are being prepared by Baldwin & Pennington, of Baltimore, for rebuilding the Cathedral of St. John the Baptist. Rev. M. T. Reilly, rector.

Lexington, Va.—A new building will be erected at the Washington and Lee University to be known as the Tucker Memorial Hall. Estimated cost, \$30,000. Wm. G. McDowell, architect.

Chester, Pa.—The foundation of the St. Paul's Episcopal church will be laid this fall. Rev. France M. Piatt, rector.

Pratt City, Ala.—The Baptist Society will build a stone church with a seating capacity of 800. Rev. J. V. Dickinson, pastor. W. E. Spink, Birmingham, architect.

Oak Park, Ill.—Ground has been broken for the erection of a \$40,000 church by the Grace Episcopal Society. Rev. C. P. Anderson, rector.

Washington C. H., O.—The new Masonic Temple valued at \$50,000 burned. The temple was insured and will be immediately rebuilt.

Ingram, Pa.—A \$12,000 church will be erected by the Presbyterian Society. James N. Campbell, Pittsburg, architect.

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THE BRIDGE OF AUGUSTUS AT RIMINI.



STONE

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MACHINE VS. HAND-CUT STONE—A DISCUSSION. ✓

NOTE BY THE EDITOR.—The text of this article is printed as it was written by the author. Editorial revision has been made in the punctuation only.

When the beautiful profiles of cut stone are decayed,
The Planer's destruction will then be essayed;
Our art will have lost all its beauty and grace,
Through machinery usurping Old Handiwork's place.
Then why not arrest and condemn this great sin?
And let poor Old Handiwork come back again;
Then with care and attention to skill and to stone.
The ones yet to come will find our work well done.



IN my last essay I endeavored to portray the degeneration of architecture by the use of machinery on stone. The true architect must be a true man. I know of no art which requires a more perfect knowledge of general ideas, for with all previous examples he may have to refer to, the vast range of his art requires a certain amount of originality. He must arrange a combination in his exterior decoration, whereby the truth and poetry of his mind is truly expressed, for a true mind cannot, without a great rupture of its noblest principles, separate itself from its work. Again, his knowledge of the comforts, tastes, luxuries, and the various demands of modern civilization are called into action for the interior arrangement of his structure, be it a cottage, workshop, office building or palace. I think all careful observers will admit that this branch of his art has been brought to a degree of perfection beyond the wildest dreams of luxury. I stated in my last essay that architecture was in no way imitative, yet we can make comparisons. The useful or interior part of architecture has been almost brought to perfection. The interior anatomy of man is perfection, yet no matter how perfect a man may be in this respect, if his outward appearance

is deformed, we either turn away from him, or pity him, never troubling ourselves to see if God, the "Supreme Architect," has been good to him in other respects, unless our attention is called by the exercise of his physical powers. So it is with a structure whose interior is perfection, yet neglected on the exterior, of which I am sorry to say there are many. The mass of the people are not privileged to enter these places, to see and feel what their fellow-man is capable of accomplishing. In both cases we lose that grand pleasure, the proximity and halo of a master mind. This is the paramount reason why we should pay more attention to exterior decoration and its preservation. Competition is the prime motor of the use of machinery, but is it not folly to lose sight of the true object by a mad scramble for wealth, or maybe a bare existence, which I have no doubt this keen competition will lead to.

To begin at the beginning, the man who is going to build, if he has not some favorite architect, begins to peddle his desires. He wants a building for some certain purpose, which shall be commodious to the size of his plot of ground, the interior of which shall equal or excel any of its kind. He has only so much money to lay out on it. Finally he finds an architect whose conscience is rather elastic, who is willing to forego the honest principles of his art to earn a dishonest dollar. He in his turn peddles the work to men of the same caliber as himself. The result is the owner gets beaten at his own game. The exterior of a building, if it is to be built wholly of stone, is a great item, if not the greatest; its beauty, stability, and durability are sacrificed to reduce the cost to a minimum. It is here the machine comes in with its destruction; its cheap production makes it a special factor in the sacrifice. The machine would not be a cheap producer if it had to cut the stone so as not to injure its durability, as then the production of work would not warrant its being used, as it would be too expensive; but by being forced and driven through the stone, it produces a great amount of work at the expense of the durability of the stone. The excuse or plea which is given to architects (who in a half-hearted manner don't care to have their work cut and finished by the planer) by the firms who use machinery, that they only rough it off with the planer and finish it afterwards by hand, is a base assumption, for there is not a firm with planers in the city who does it. If the architect would employ an inspector whose integrity was not to be tempted he would soon find the matter out for himself. It is a justification to himself as well as to the owner to have such an inspector, for architects as a rule are too busy to attend to these outside matters, which I can assure them are very vital. Together with being burnt and the life and nature taken out of the stone by the planer, small fillets are ground so that the fingers are almost able to press the edges off, also beads and other undercut members are stunned the whole length of the

stone, while in many cases they come off altogether, only to be fastened on again by shellac. These, by their own weight, not being dovetailed or dowed, will in a short time drop off, if not, the weather will soon complete the defacement and destruction.

The machine is making architecture a commercial business instead of a great art it is a case of clothing a building in a cheap machine-made suit, instead of a fine fabric made by human hands. How many of our great men of the present day would be passed by unnoticed were they dressed in patches? As the great poet says: "The apparel oft proclaims the man." A man's work is the being of his mind; it is like an open book to the observing student. What curious thoughts defective work must stamp upon the clean folios of his studious and ambitious mind, unless he should chance to be a student under some desecrator of this ancient art—then he would merely call it business, saying that the price possibly warranted such bad workmanship and worse construction. I have no doubt his conclusions may have been correct, but who is in fault? The architect or the builder? Possibly both. But I should blame the architect most, for he should have respect for his art. Again, circumstances excuse the architect to a certain extent; for he may sincerely wish to enter into and exercise the wonderful range of his art, and go into grand details, which he has long been cherishing and storing up in his vast storehouse; but he knows that if he proposes this, the owner will go elsewhere, where he will find the many arraigned against the few, who are willing and eager to sacrifice their art and principle, and allow this man who knows absolutely nothing, maybe, of architecture, to put forth his crude ideas, and have them carried out, simply because his own selfishness will not allow him to give to the world what fate and nature have given to him, that is, the means to gratify all his senses. In such cases the honest architect should look around him, and observe the rapid growth of the members of his profession, many of whom have no right to lay claim to such an aspiration; their principles, intellectuality and lack of knowledge in this great art should debar them from it. He should gather his brethren together, and try to form some remedy for it. I am sure any one with common sense, would uphold them in anything they chose for the better. Had machinery been used by the ancients, our antiquaries and archæologists would find it very difficult, I am sure, to trace the origin, of the different styles of architecture, in fact it would be impossible, for gradual development could not be traced owing to the decay, which must necessarily follow this method of cutting stone. Ruskin's studies and research, in Venice and elsewhere, would never have been so interesting as they are; he might just as well have gone to the quarry, to trace the various transitions of style. He would have found no mouldings intact, but only a decayed mass. What a deplorable thing that would have been? What a

sad picture it would be to go through a city renowned the world over for its progressive industry, and skill in all branches of art, whose architecture should be a living evidence of its greatness; to find instead, evidence of decay all around; each imposing pile we view, to find it stripped of all its loveliness by want of thought and care on the part of its creators. The thought is unbearable, yet this is what we are fast aiming for, if we do not attempt to arrest it.

Architects do not seem to realize the damaging effect of the planing machine on stone; some say they do not see any objections to it; that its work looks better and straighter than hand work. Do we compare the other fine arts with the same value? No, we stand by the old works made by hand, and hold them up as examples for all students to study and copy. Then why should we debase this grandest of arts, applying machinery to it, which not only takes away all its pretensions to the roll call of arts, but will destroy its very existence, leaving no evidence of skilled labor or architectural genius? Stop it at once, for our own good names and welfare, and for the benefit of future generations! Of what use is it for promising students to go to fine schools of art in Europe, if their productions are put forth only to decay, leaving no evidence of their skill? It has been condemned in Europe, why not condemn it here? Then your art would be an art, and not a manufacturing business. We seem to be losing sight of exterior architecture altogether, and giving all possible attention to the interior. Are we degenerating or what is the reason? There is some cause for it. I think it is a selfish catering to the inner man.

We all know that when great pressure is thrust upon stone it will crush or become pulverized and drop in pieces; iron will spread under pressure and wood will solidify; the two latter will allow the pressure of the planer without injury, but stone becomes pulverized, and not adapted by nature for the planer. Evidence of this is already showing on machine-made buildings. If we take a look at the numerous buildings in the city, where the stone has been cut by the planing machine, and compare the mouldings with the style from whence they have been taken, we shall find that their beautiful profiles are lost entirely. They have been stunted and dwarfed to suit the planer. I leave it to the architect to say if he curtailed them, or some one else did it unknown to him. If the latter, he ought to be able to recognize it and condemn it. This dwarfing of the mould renders the planer less liable to burst the members, though if it should lift them off, the stone is not cast aside as it should be, or cut over again, they are just stuck on with shellac, and that is the end of it in the stone yard, but not in the building where it will drop off sooner or later, defacing the whole work.

If we continue we shall get back to the early ages of architecture when a splayed stone was the only ornament they had. Some of the present

mouldings look little better than a splay, above the third story in some of the machine-made buildings. Of what avail has been the work of our old masters, working out the beautiful curves of rich mouldings, if we are going to allow them to be tampered with to suit a purpose of gain? Examples of the foregoing are plentiful in the city, and any person with a practical knowledge of architecture does not need to search far or long to find them.

Henry Gorse.

TESTS OF BUILDING STONES.

ONE test of a good building stone is, that when fractured, it shows a compact structure, and has a bright crystalline appearance; if, on the contrary, it shows a porous structure and a dull earthy fracture, it may be considered as unsuitable. The chief qualities required in building stones are strength, durability, size, color and ease in working. The decay of stone is caused principally by the expansion of water in its pores in the act of freezing, by which the particles of the stone are split asunder; hence the advantage of a compact structure.

It is also caused by chemical action, as in the case of a porous calcareous stone exposed to an atmosphere containing sulphuric acid. The only sure test of the durability of a stone is experience. Before, therefore, using any given stone, an examination of the buildings in which it has been used should be made, or an examination of such portions of the rock in the quarry which have been long exposed to the atmosphere.

To ascertain the comparative durability of marble or other calcareous stones, immerse equalized cubes of the various stones in dilute muriatic acid of the same degree of strength in different vessels. Those which dissolve most slowly will be least liable to decay. Palladio says soft stones, and stones the nature of which we are not acquainted with, should be quarried in the summer, and exposed for two years to the effects of air and frost before being used.

When this cannot be done, stones that are not calcareous may be tested in some degree by immersing them in water, by exposing them to a red heat and to frost, or by covering them with dilute nitric acid for several days. The stones which absorb the least quantity of water, and which are least changed by the action of acid, heat, or frost, may be fairly considered as most capable of resisting the effects of the atmosphere.—The Stonemason.

LONDON BRIDGE.

THE most renowned of modern bridges is the New London, which was built in 1831 by George Rennie as engineer. It presents a great contrast to the old bridge, which was deficient both in width and waterway. The largest of the five arches is 152 feet span, the rise being 37.1 feet, and the depth of keystone 4.9 feet. The roadway is supported over longitudinal arched voids and has a very easy grade.

The beautiful elliptical outline of the arches is but one of many details by which an appearance of great elegance was obtained. The starlings of almost perfect design are coped and capped in an appropriate manner, and support counterforts, which are very effective in overcoming any tendency towards flatness of design. The parapet or cornice is supported by corbels, and while of the simplest design is in entire harmony with a most studied and effective piece of bridge architecture.

The unsightliness of the piping which is laid on top of the cornice would suggest the necessity in modern structures of providing a conduit for pipes, wires and other similar appurtenances of modern civilization. "F."

BRIDGE OF AUGUSTUS AT RIMINI.*

PROBABLY the most copied of old Roman bridges is the one built by the Emperor Augustus at Rimini. There are five semi-circular arches, which was the universal Roman outline, the two spans next to the shore on either side being of twenty-three feet five inches span, and the three intermediate spans of twenty-eight feet nine inches span.

The piers are very thick, being nearly equal to half the opening, and rise thirteen feet one inch above the water, carrying columns which support an entablature. The remains of decorations on the keystones, the ruined cornice and other details, indicate that the bridge was one of great elegance.

That some of the design should have been duplicated in other structures was indeed fortunate, but that the columns and entablatures were added to the bridges of later design, points to this as an unfortunate field of study for modern engineers. This detail could be replaced by counterforts which would be appropriate and harmonious as well. "F."

*Subject of Frontispiece.



LONDON BRIDGE, LONDON, ENG.

SOME ANCIENT RELICS IN JAPAN.*

FOUR stone figures in a small inclosure near Hirata Mura, in Southern Yamato, are probably the oldest stone images in Japan. I visited the place, in company with W. Gowland and K. Nagai, on the afternoon of April 1, 1888. The figures are at the foot of a small circular mound on a slight elevation, near the misasagi of Kimmei Tennō, surrounded by a hedge, with a securely locked gate in front. The small mound itself is said to be the burial place of Kibi hime ō, the mother Kokioku Tennō and Kotoku Tennō.

While at Nara we presented letters to the governor of Nara ken, and stated our desire to have the gate opened that we might examine and make



FIG. 1.—STONE FIGURES FROM YAMATO.

photographs of the figures. An official letter was accordingly sent to the man in charge, and on our arrival we were met by a police officer, a number of local officials, and most of the villagers, who escorted us to the place. But when we asked to have the gate opened we were told that it could not be done without permission from the Imperial Household Department at Kyoto. This is a characteristic example of Japanese official courtesy such

*From Annual Report of U. S. National Museum for 1891.

as we more than once experienced. The workman is free to enter the mound inclosure and care for it, but gentlemen engaged in archæological



FIG. 2.—STONE FIGURES FROM YAMATO—SIDE VIEW.



FIG. 3.—ANCIENT STONE PAGODA.

studies are not permitted to have the gate opened, even when they do not care to tread inside, but only to get a clear field for a photograph. However, with some difficulty we contrived to make several pictures. There

being no official regulation about cameras, I ventured to plant mine inside the hedge and work it from without, which was done without remonstrance. The result is shown in plates I. and II., which are different views of the same figures. The resemblance between these rude carvings and the images of Easter Island are quite noticeable.

The story told in a Japanese book, the *Koko Nichi Hoku*, a work on Japanese antiquities, dated the ninth year of Kwansei, was translated by Mr. Nagai as follows: "Long ago, four stone men were dug out of a field near Kimmei Tennō's misasagi. The first one had three faces, the second four, the third three, and the fourth two. Afterwards the natives put them on the misasagi and called them *Schichi fuku jin* (seven happy gods), which of course means nothing. The significance of the figure is unknown, but



FIG. 4.—ANCIENT CAVE WITH REMAINS OF A STONE PAGODA.

some persons think that they were made for the pleasure of the workmen, and perhaps this may be so."

The figures are undoubtedly of great age, and of far more interest than the above account would indicate. They show traces of more than a common workman's skill, and while speculation concerning them is now profitless, they may some day prove of importance. The largest stands about four feet in height.

We can approximate to the date of some of the old Japanese monuments with some degree of confidence. For example, in the Province of Kawachi, a short distance from a much frequented pass over the mountain, there are some very old relics of Buddhism. On the top of a projecting spur of the

mountain stands a weather-worn stone pagoda (plate III.) known as the *jiu-san to*. Its history is unknown, but it is probably one of the oldest Buddhist monuments of Japan. Near by and facing it is the remains of a cave, the roof and sides of which have almost crumbled away, leaving the back clearly exposed. Some roughly-drawn characters may be traced on the back, one of which evidently represented a face of a Buddha. There are other rocks near, which also bear traces of sculptures, but the forms can not be made out. Somewhat lower down there is a spot where it is evident there once were other stone structures, but it is impossible to infer their character or significance. A short distance from this place, in plain view, on another hillside, there is a second cave, evidently much larger, within which are the ruins of a stone pagoda (plate IV.)

It was during the lifetime of the famous priest Shotoku Taishi, early in the seventh century, that Buddhism became firmly established in Japan, and many of the most celebrated temples were built by him. Among those are Horiu-ji, in Yamato, and Tenno-ji, in Ozaka. The tumulus of this Mikado is at the temple Eifuku-ji, near the village called Kasuga, in Kawachi, at the foot of the mountain where these relics are found.

Considering the very active part taken by Shotoku Taishi, in establishing the Buddhist religion, and the fact that these ruins are found between his two most famous temples and near his final resting place, it seems probable that they date from his time or earlier, and are therefore more than 1,200 years old.

Romyn Hitchcock.

ONLY DRESSED GRANITE FOR PAVING.

THE department of public works in Chicago has decided that in issuing contracts for the paving of streets with granite, only the so-called "dressed" granite will be permitted by the specifications in future. This granite is quarried in Wisconsin, and consists of blocks about four inches wide, eight inches long and with an unvarying depth of six inches. These are dressed very smoothly on all sides, like brick, so that when imbedded in the sand they will settle to a uniform depth and be perfectly even on top. The space between the blocks is never more than one-fourth of an inch in width. The crevices are filled in with sand and asphaltic paving pitch, which when hardened firmly holds the blocks on all sides. The work, as being done, consists of a foundation of cement concrete eight inches thick covered with a layer of sand, in which the granite blocks are imbedded, and it is as smooth and even as asphalt or brick pavement, and yet it has sufficient roughness to prevent horses from slipping in wet weather. The cost of constructing streets with the new granite is greater, but it is said that the durability of the paving will make up for the excess in cost.



STONE PULPIT IN ST. MATTHEW'S CHURCH, QUEBEC.

Felix Morgan, Architect and Sculptor.

The pulpit is built of English sandstone. The columns are of various marbles; the cap moulding and figures of St. Peter, St. John and St. Matthew are of alabaster.

(From Canadian Architect and Builder.)

THE ONYX-MARBLES.*



HE notes in this paper are the result partly of individual investigation, partly of information furnished by engineers and others who have studied onyx-marble deposits, and partly of research in the scanty literature upon this subject.

In the beginning a sharp distinction must be drawn between the precious onyx, which is a cryptocrystalline variety of quartz, and the ordinary commercial "onyx," which is a deposit of carbonate of lime from aqueous solution. The true, or precious onyx, is distinguished arbitrarily from the agates by the perfect parallelism of the color-bands, these bands consisting usually of alterations of white and black, white and brown, and white and red. It may be mentioned, in passing, that such perfect banding is so exceedingly rare that very few, if any, of the onyxes or cameos sold in our jewelry shops are from naturally-colored stones, the artificial coloring of agates being a regular industry in Germany. The method is said to consist in saturating the more porous layers of the banded white or bluish slate-colored agate with honey, and then carbonizing this with sulphuric acid to produce the black and white variety. The red-and-white is produced by soaking in ferric chloride and oxidizing with ammonia. Such a red coloration should consequently be obtained in any porous stone by similar treatment; but my personal experiments in this direction have been unsuccessful, or, at best, have resulted in a dirty ferric-oxide stain.

The term onyx-marble, as applied to calcareous deposits, must be still further limited, since many varieties exist. The general name of travertine will include all such deposits except the finely-crystallized minerals calcite and arragonite. The oölites should also be excluded from this classification, although in their manner of formation these more nearly approach the true travertines. The familiar calcitic formations in caves (stalactites, stalagmites, "cave onyxes") may quite properly be classed among the travertines. That which entitles any of these to be called an onyx-marble is the accidental circumstance of texture and beauty, fitting it to serve as an ornamental stone in decoration. It is, therefore, a commercial and not a scientific distinction.

The requisite qualities for a commercial onyx-marble are: First, perfect, or nearly perfect, homogeneity of texture; second, absence of subcrystalline

*Prof. Courtenay De Kalb, School of Mines of the University of Missouri, Rolla, Mo., before the A. I. Min. Eng. in 1895. Published in response to numerous inquiries regarding onyx marbles.

structure, so that no tendency to crystallization may be observable by the eye; third, freedom from porosity and cracks (although slight porosity may be corrected by "filling," and cracks, if not so deep and extensive as to weaken the stone, may often be highly colored and produce an acceptable artistic effect); fourth, translucency, the *sine qua non* of a high-grade onyx-marble, giving a deceptive appearance of "depth"; fifth, beauty of coloring—a matter of taste and fashion, for the most part, although the translucent white, delicate mignonette green, and fine translucent white, with dashes or veinlets of pink, are almost always in demand and bring the highest prices; and sixth, proper size of perfect blocks, the lowest limit for thickness being one inch, although slabs three-fourths of an inch thick are sometimes used, with a "backing" of other material, while for superficial area the line is drawn at one foot square, although here, again, smaller sizes, if very fine in color and texture, may be marketed.

The translucent white onyx-marbles are very often confounded with and sold under the name of alabaster, the true alabaster being a translucent variety of gypsum, and far less durable, owing to its greater softness, than onyx-marble. Again, we find in commerce a stone called "agate onyx," which is a variety of onyx-marble containing more or less foreign matter, chiefly alumina, and sometimes silica, approaching the agates in appearance, but generally inclining, in part or in whole, towards opacity. While being highly ornamental, particularly in connection with dark wood interior finishing, its application is more limited than that of the finer, translucent varieties.

Before leaving the commercial side of this matter, a few additional details may prove of some importance. The highest prices are obtained by a combination of desirable physical characters with large size of blocks or slabs. The poorer grades bring sometimes as little as fifty cents per cubic foot; onyx-marble, in the rough at least, being invariably sold by this unit of size, whether in blocks or sawed into slabs. From this minimum, prices range upwards to \$50 a cubic foot; and extremely fine blocks, suitable for columns, may command fancy figures, limited only by the size of the purchaser's purse, and the vending genius of the dealer. It may be said, however, that the average size of good slabs is only 12x14 inches, and that slabs 18x36 inches, and 2x4 feet in size are not uncommon.

The cost of sawing and polishing varies according as the polishing is done by the machine or the hand process. The sawing differs in no wise from that employed with other stones. The machine process is as follows: After being sawed, the slabs are placed on a "rubbing-bed," which consists of a circular cast-iron plate, from eight feet to fifteen feet in diameter, the older forms having a circular opening, from one foot to eighteen inches in diameter, in the center. The plate is planed to a smooth surface, and is

mounted upon running-gear so that it may revolve in a horizontal plane. Fixed arms, usually four in number, are sustained radially about one-fourth of an inch above the plate, either by an upright passing through the central opening, or by a framework overhead (in the case of the newer solid forms of bed). The slabs of stone to be polished are placed upon the bed in front of the arms, and the bed is revolved slowly beneath them in such a direction as to hold them firmly against the arms. An abrading material, such as sand, sometimes mixed with "chilled shot" or crushed steel, with a constant supply of water, is fed upon the plate. If necessary, the stones are weighted to increase the friction. From this rubbing-bed the slabs are removed to the emery-bed, which is similar to the former, fine emery being used for abrasion. They are then rubbed down by hand with a fine, evenly-grained sandstone, commonly called a "Scotch hone," with a sufficient supply of water, and smoothed off with pumice stone and water. The final polish is put on by rubbing the slabs upon a buffing-bed, similar in form to the rubbing-bed, but covered with a thick, specially prepared felt, upon which a small amount of "putty powder" (oxide of tin) is fed, to give a high gloss. The hand-process consists in grinding on the rubbing-bed as before, and then rubbing down by hand successively with Nova Scotia "blue stone," "red stone," "Scotch hone," and pumice stone after which it is glossed with "putty powder," or, in the case of cheaper "onyxes" and common marbles, with a mixture of two parts of oxalic acid and one part of tin oxide. This latter finish produces a sort of "skin-coat," which, upon fracture, looks as if the stone had been varnished. The edges of onyx-marble table-tops, mantels, etc., are treated in this manner, even when the surface has been polished on machines. The use of common emery with white stones is objectionable, owing to its tendency to discolor them.

The principal localities in this country where important deposits exist are California, Arizona, and Utah. In California the principal locality is in San Luis Obispo county, near Musick, in the Santa Lucia mountains. Here the inclosing rock is sandstone, the onyx-marble occurring in nearly vertical ledges sixteen inches wide. The colors are white, with veins and "clouds" of red and smoky-black or blue. Blocks ten feet square are said to be available. In Solano county deposits occur near Suisun, Vacaville, and elsewhere. In San Bernardino county occurs a light-brown variety, and an emerald-green shade is reported from Siskiyou county, along with others from Soda Springs and Yreka. A ledge twelve feet thick is found twenty-five miles from Santa Ana, in Los Angeles county, and more or less is known to exist in Kern, Placer and Tehama counties. Almost without exception, in California, a close connection can be traced between the onyx-marble deposits and hot springs, or other mineral deposits known to have resulted from such waters. In Siskiyou county they occur along with hot

springs which are depositing both onyx-marble and porous travertine. Eruptive rocks also abound in their vicinity. At the Suisun marble quarries is a breccia of shale, sandstone and volcanic ash, cemented by lime, and traversed by veins and bunches of arragonite (?).

In Arizona quite similar conditions obtain. The chief deposit is on Big Bug creek, in Yavapai county, twenty-five miles southeast of Prescott. It is a surface formation, occupying a series of rounded knolls several hundred acres in extent, and is found in layers varying from a fraction of an inch to several inches in thickness, interbedded with a coarse breccia of schistose, granitic, syenitic, and dioritic fragments, cemented together by a sandy calcareous matrix. The country-rock is also schistose, granitic, and dioritic. The onyx-marble deposits themselves consist of irregular concentric layers, thinning out unevenly, with compact layers, frequently separated by porous ones. The colors are variable. Some of the finest reseda-green onyx-marble in the world comes from these quarries. Their beauty is enhanced often by a peculiar wavy effect of alternating light and dark shades of green, but such colors are rarely uniform throughout large blocks. Amber, ocher-yellow, and white masses are found; but the characteristic of these Arizona specimens, which is sure to appear in a slab of any considerable size, is a brilliant ocherous red, running into a perfectly opaque chocolate brown, constituting the variety known as "agate onyx." The more highly-colored specimens often yield as much as five per cent. of ferric carbonate. This changes to the hydrated sequioxide, producing the brown shades and destroying the compact structure of the stone.

At Cave creek, Arizona, is another deposit of like character, as to formation and colors. One ledge is ten feet thick, but has been shattered by earth-movements. This is on the slope of a low hill, capped with basalt. The country-rock consists of schists, with dikes of acid eruptives. Throughout this region are large areas of lava *mesa*, underlain by volcanic tufa. These yield the calcareous waters, which also contain more or less sodium sulphate. It is also worthy of note that, in the Eureka mining district of Arizona, there are other deposits of travertine below similar beds of tufa and lava.

Utah is becoming a producer of onyx-marble, with prospects of increasing in importance, obtaining the stone from quarries to the west of Utah Lake. Directly above and in contact with the onyx-marble is a blue limestone. The deposit rests upon clay, sand, and limestone. There are many evidences of earth-movements, and the range in which the deposit occurs abounds in metalliferous veins. Six miles distant there is a hot spring issuing upon the surface at a temperature of 105° F. The predominating color of this onyx-marble is orange, but green, pink, lemon, and other shades are procured. Slabs measuring 10' 6" by 5' 8" have been taken

from these quarries and finished up. Sizes from 12x18 inches to 12x36 inches can be obtained in considerable quantities.

Deposits are also reported from the vicinity of Fillmore, Millard county, ranging in color through lemon, orange, mahogany, and black. The onyx-marble occurs mostly associated with limestones and quartzites, along a belt of warm springs, running through Millard, Beaver and Iron counties. These springs occupy mainly a line of contact with eruptive rocks.

A fibrous, concretionary variety of onyx-marble occurs near Rio Puerco, in Valencia county, New Mexico, and a similar deposit is reported from El Paso, Texas. This description would seem to place them among the "cave-onyxes," concerning which much is heard in nearly all of the great limestone-bearing states in the Union. These are merely stalactites and stalagmites, and in some cases masses of compact travertine, forming incrustations upon the walls and floors of caves. One of these deposits is at Eureka Springs, Ark., situated in the northeast part of Carroll county, near the Missouri line. A company operating works in Eureka Springs produces mostly small slabs, although mantel facings 12x24 inches in size are also worked out. The colors are chiefly white, with occasional tinges of red and pale green, rarely translucent, and often displaying the radiated fibrous structure so common in stalactites and stalagmites. Missouri has also produced small amounts from caves in Crawford and Pulaski counties. Sound blocks of large size, however, are infrequent, and efforts to work these deposits have proved unsuccessful. The colors are white and brown, varying from opaque to sub-translucent. Virginia has also yielded a small amount of this variety of onyx-marble, coming from quarries in Rockingham county. This locality, from the insufficient accounts obtainable, would appear to offer peculiarities worthy of further investigation. There is reported to be one considerable mass of compact travertine, covered with debris, in which occur a large number of detached masses of the same material, one of which is of important dimensions, standing nearly vertically. Whether or not this is the result of a collapsed cave remains undetermined. In Missouri some of the largest masses of "cave-onyx" are found thus in the debris of ancient caves which have fallen in. Some of these caves had been of enormous extent, so that deep ravines and very considerable valleys occupy the lines of the ruined caverns. Stalagmitic bosses may be found high up on the hillsides along these ravines, and the "float" abounds in weathered fragments of stalactites, stalagmites, and calcareous incrustations. In the process of weathering, the banded structure of the incrustations becomes very prominent, the more opaque layers projecting boldly, while the clearer layers are worn away, and acquire a chalky appearance in the body of the mass. The Arizona onyx-marble weathers similarly, forming a finely-striated surface, with the opaque red and brown layers protruding.

By far the most important source of onyx-marble in the world to-day is the Republic of Mexico. The old localities are chiefly in the State of Puebla, between Vera Cruz and the City of Mexico. The famous "Pedrara" came from quarries near Tecali, twenty-one miles from the city of Puebla. Large blocks are no longer available there; but the manufacture of small ornaments by the natives is still an important industry in Puebla. Further to the southeast, in the district of Tehuacan, is the quarry known as Antigua Salines, where the principal deposits form the face of a hill 250 feet high. Thirty-five miles west of Antigua Salines are the excellent quarries of La Sorpresa and La Mesa, the former yielding a semi-translucent to whitish stone, lacking, however, in the brilliancy which distinguishes the product from the Antigua Salines. These deposits are either superficial or included between masses of siliceous country-rock, in the manner of veins. The old Tecali deposits are largely broken up, occurring in the form of boulders in a matrix of red clay, overlying conglomerate. The region has been much disturbed by volcanic agencies, and hot springs are abundant.

The largest onyx quarries in the world to-day are those opened in 1892 by the New Pedrara Onyx Company, of New York, in the peninsula of Lower California. They are situated in a desert forty miles from the Pacific ocean and 2,300 feet above its level. There are two series of deposits, three or four miles apart, the larger one showing outcrops over twenty acres. They have been formed in a shallow arroyo, or ravine, between flat-topped ridges of horizontal Cretaceous strata, overlain a few miles distant by basaltic lavas. A writer in the *Engineering and Mining Journal* says: "Within the arroyo, and immediately under and between the layers of onyx, are soft limestones and conglomerates with lime cement, probably belonging to a series of tertiary or recent beds deposited in an irregular lake that once filled a great interior valley which occupies the medial portion of the peninsula, parallel with its shores."*

Beneath these tertiary deposits lie granites and gneiss. The onyx-marble was evidently deposited from the waters of warm springs, which extended in a line up and down the arroyo. Three distinct superimposed layers were formed, varying from twenty to fifty inches in thickness, showing that the springs were intermittent, the layers being separated by deposits of gravel cemented by lime.

Onyx-marble is also reported from the State of Oaxaca, Mexico, but little is known concerning it.

Other foreign sources are Egypt and Algiers. The Egyptian quarries are at Benisouef, about sixty-two miles south of Cairo, on the Nile, and at

**Engineering and Mining Journal*, Vol. LVI., page 31, July 8, 1893. The description is evidently based on a report by Prof. Merrill. An account of New Pedrara by Prof. Merrill will be found in *Rothwell's Mineral Industry*, Vol. II., page 485.

Syout, 166 miles further south. The stone ranges in color from white to amber-yellow, that from Syout being paler, inclining to gray. The product of both localities is known commercially as alabaster, and is of a very different quality from the Mexican varieties. It is said to be of stalagmitic origin.

The Algerian stone from the quarries of Ain-Tembaleck, near the river Issur, is found in irregular beds from a few inches to nearly ten feet in thickness. Its manner of occurrence has not, to my knowledge, been described; but the frequent appearance of a fibrous structure is significant.

Inferior stalagmitic marbles are quarried in many places in Italy, in the Jura mountains in France, and in the vicinity of Stuttgart, in Germany. The caves at Gibraltar also furnish small masses of a banded brownish stalagmite, which is cut into ornaments for the tourist trade.

From the foregoing summary it appears that the deposits furnishing the superior onyx-marble of commerce are found in regions which have been subjected to volcanic disturbance; that they are superficial deposits or vein-like inclosures, not connected in any manner with caves; that they are so frequently associated with active hot springs, or with other deposits manifestly resulting from hot springs, as to lead to a clear presumption that there must be a genetic relation between them and such springs; and, finally, that they occur associated with limestone rocks, or with rocks yielding large percentages of lime, such as diorite (usually seven to eight per cent. of CaO), syenite (about four per cent. of CaO), volcanic tufa (four to six per cent. of CaO), and dolerite (often as high as ten to eleven per cent. in CaO). It is also to be noted that the "cave-onyxes" are, usually either transparent or opaque, and, so far as my experience goes, never exhibit that exquisite translucency recognized as the chief charm of the high-grade onyx-marbles which have resulted from hot-spring deposition. The "cave-onyxes" are, moreover, usually fibrous in structure, and are made up of concretionary layers, which can be scaled off like the skin of an onion. These latter peculiarities, however, are less likely to occur in the flat floor-deposits of caves, while the concretionary structure is the more common attribute of stalagmites and the fibrous structure of stalactites. The fibrous structure may occur, however, in any situation, and is always perpendicular to the surface of deposition; and where this surface is curved, as in a stalactite or stalagmite, the fiber-like crystals extend from the center radially to the exterior, the axes passing without interruption through successive concentric layers, which may be so loosely adherent as to be split off with a light blow of the hammer.

In their other physical characters no difference seems to exist between "cave-onyxes" and hot-spring onyx-marbles. They are all calcites, as appears from their optical properties, and their specific gravities, although many writers class them as varieties of aragonite. The distinction, how-

ever, is clear, both optically and by density, none of the "cave-onyxes" or true onyx-marbles rising as high as 2.9, which is the lowest limit for the density of aragonite. The large number of specimens from caves and hot-spring deposits in all parts of the United States and Mexico which I have examined show specific gravities ranging from 2.631 to 2.751. In composition they are exceedingly variable. The "cave-onyxes" usually contain the smallest proportion of impurities, although the floor-deposits are often rich in ferric oxide and alumina. Those from Virginia show as much as two per cent. of magnesia, with small amounts of manganese; and one remarkable sample yielded nearly two per cent. of lead sulphide, and 4.62 per cent. of antimony sulphide. A sample of green Arizona onyx-marble gave 99.84 per cent. of lime carbonate, and mere traces of iron and alumina. From two to eight per cent. of iron and manganese is not uncommon; but, so far, no copper or nickel has been discovered in these stones.*

The circumstances causing the great difference in texture and translucency between the "cave-onyxes" and hot-spring onyx-marbles have not yet been fully determined; and there is opportunity for trained observers to render valuable service in this particular. The greater degree of concentration of the hot solutions has been undoubtedly an important factor, and it may have been the determining one. Rapidity of flow also exerts an influence, the greater the velocity the more rapid the deposition, a circumstance first pointed out in connection with the travertine deposits, I believe, by Lyell. In caves this becomes very conspicuous. On a sloping roof, for example, the stalactites increase in number and size towards the steeper portions where the flow of the oozing waters is greatest, and incrustations form thickest upon the vertical walls, thinning out upon the floor, unless obstructions favor the building up of ledges, resulting in basins. In such cases the ledge grows upward and outward, but the incrustation again thins out upon the floor beyond, where the flow of the water is checked.

The source of the lime carbonate in cave-waters is of course the surrounding limestone, taken up by the feebly-solvent vadose circulation. They are consequently weak solutions, whereas the deep-seated plutonic waters, under high pressure and temperature, become highly charged with mineral matters. It is difficult to understand, however, that such waters rising from great depths should be so rich in lime carbonate, and yet contain so small a proportion of other ingredients, as to deposit onyx-marbles running as high as 99 per cent. in lime. The question seems a fair one, which I should like to have answered, whether the other mineral matters may not have been deposited from these solutions in the course of their ascent, and whether they may not then have derived their lime carbonate

*According to Prof. Merrill.

from rocks near the surface. The frequent connection of such deposits with superficial limestones and other highly calciferous rocks tends to confirm this suspicion. That the other mineral matters should have been largely deposited below, leaving the lime carbonate still in solution, appears hardly tenable; for there is good reason to believe that mineral compounds are deposited in the inverse order of their respective heats of formation, or at least that there is an approximation to such an order, and, if this be true, lime carbonate should be deposited much earlier, and hence lower down, than a large proportion of the other substances which such waters would be expected to carry, its heat of formation being as high as 172.4.

It appears that the formation of the translucent compact variety of travertine, known as onyx-marble, is therefore due to exceedingly rapid deposition of lime carbonate from highly concentrated solutions, probably in rapid motion. Absence of pressure seems to be another requisite, judging from the circumstance that deposits of lime carbonate occurring in deep situations, as shown in metalliferous veins, take the form of well crystallized calcite. Further data concerning the character of the vein-like masses of onyx-marble, such as those at Antigua Salines, at a considerable distance below the surface, would be desirable as bearing upon this point. Finally, it may be indicated that, guided by empirical knowledge, prospectors would do well to search for this valuable stone in volcanic regions where hot springs do now, or formerly did, exist in close association with superficial accumulations of limestones, or lime-bearing plutonic and igneous rocks.

Prof. Courtenay De Kalb.



✓ PRACTICAL STONE-CUTTING.—XII.

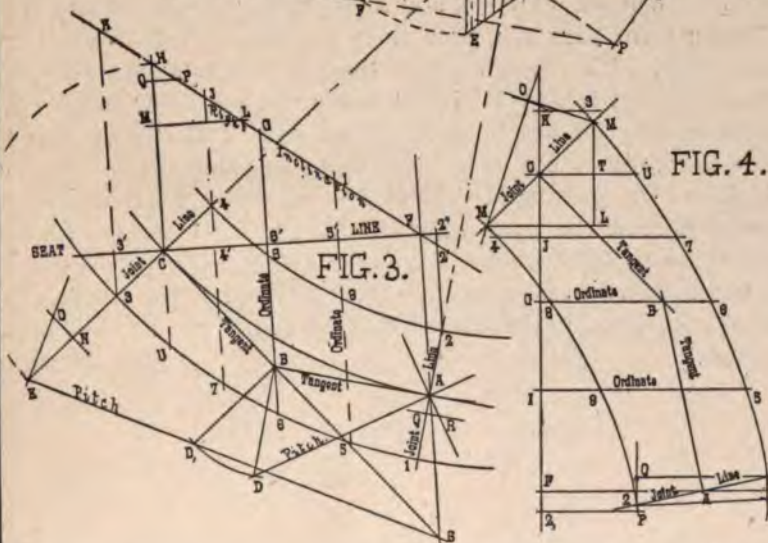
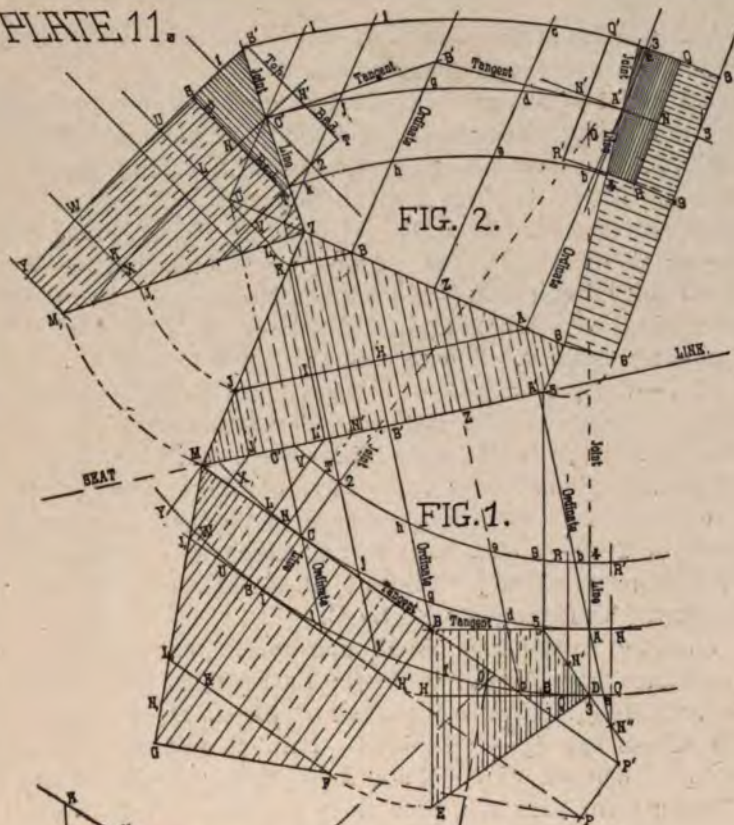
THE CONSTRUCTION OF A CARDBOARD REPRESENTATION OF A SOLID, SHOWING THE DEVELOPMENT AND ACTUAL POSITION OF THE BED AND JOINT SECTIONS, AS REQUIRED AT A PIECE OF COPING, THE PLAN OF WHICH IS LESS THAN A QUARTER CIRCLE, THE RISE OR INCLINATION OF THE SECTION PLANE OF BED MOULD BEING UNEQUAL OVER THE PLAN TANGENTS.



IN Figs. 1 and 2 are explained the construction of a representation of a solid, showing the actual position of the bed and joint sections, together with their developments, as required at a rail or coping, the plan of which is less than a quarter circle, the inclination of the section plane of the bed mould being unequal over the plan tangents. This is a problem similar to that shown at Plate 10. There the greater rise has been placed over the upper tangent; here it is placed over the lower one.

The plan is shown in Fig. 1. O represents the center with which the plan curves may be drawn. A—B, B—C are tangents respectively to the points A—C at which joints are desired. We have already explained that in order to show at the model the whole of the joint surface which belongs to the lower joint, the ground plane at the model requires to be raised a vertical height as shown in A—D, B—H', of Fig. 1, and A'—A, J'—J, of Fig. 2. Understanding this, the student will proceed in the manner already explained at other models, to find the direction of the level-directing ordinate P—A—A' and the parallel plan ordinates c—Z, etc.; then set off the rise H—E, H'—F of the plane over the lower tangent, and K—G that over the upper tangent; then by joining G—F, E—D the pitch over the plan tangents of the section plane may be projected. Then square with P—A—A' draw M—5 the "seat line." Now set off A'—A equal with A—D below. Make C'—C equal with C—G of Fig. 1; then joining C—A (Fig. 2) the true inclination of the section plane of the bed mould may be obtained. Then square over the ordinates of the section plane develop the curves of section which belong to the bed and joint surfaces in the manner fully explained for the like operations at other models. Then cut out the model to its desired shape, bring the sides together with the lines on the outside for reference, and the model may be completed. Then in the manner already explained cut the full-sized joint sections and face patterns, and place them

PLATE 11.

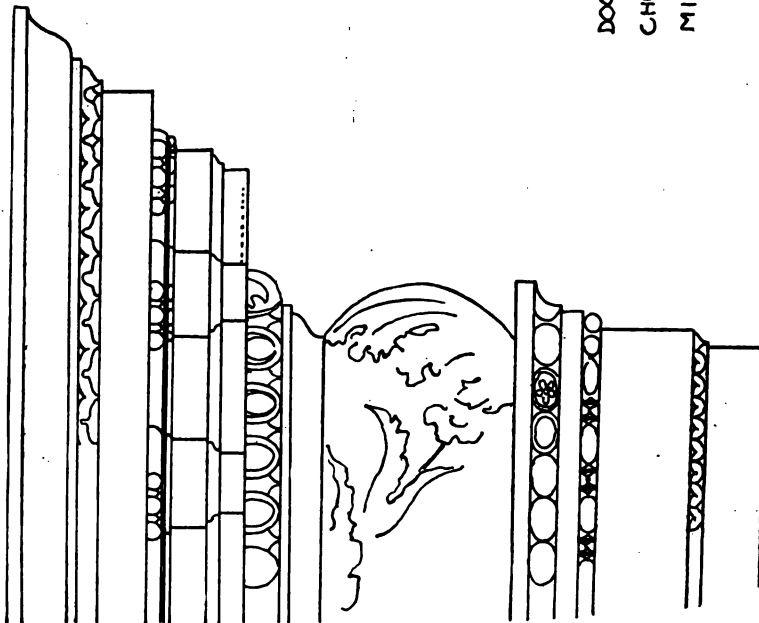


in their proper position at the model. In this manner the twist of the top and under surfaces of the coping may readily be seen.

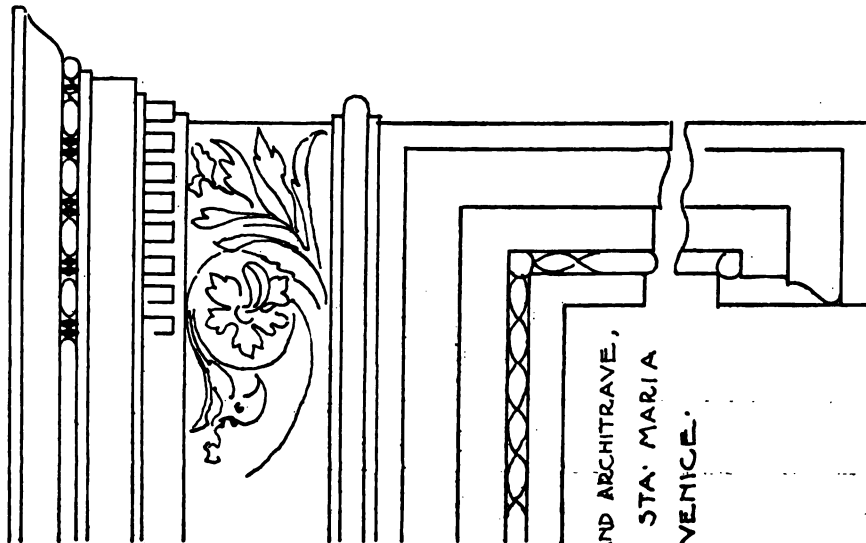
In Figs. 3 and 4 are shown the method which may in practical work be adopted for developing the curves of bed and joint moulds. The plan is shown in Fig. 3. O represents the plan center with which the plan curves may be drawn. A—B, B—C represent the tangents to the points A—C at which joints are desired. B—D, B—D, shows the rise of coping over the tangent A—B; C—E the total rise of coping over its plan curves. Produce tangent C—B indefinitely; then produce the pitch E—D, to meet the line as shown in S; join S with A produced and the direction of the level-directing ordinate may be obtained. Square with this draw C—F the "seat line." Then set off C—H equal with C—E below. Join H—F and the true inclination of section plane may be obtained. Now produce the plan ordinates to meet this line. Then in Fig. 4 set off 2,—F—I, etc., equal with 2'—F—I, etc., of Fig. 3. Square over the ordinates. Make the length of these equal to that of the corresponding ordinates of the plan, and through the points given in 2—9—8, etc., trace curves which will complete the bed mould. As before stated the joint lines 1—2, M—M' are at all times drawn at right angles with the tangents A—B—C.

Now to find the direction of plumb line at the joint surfaces: Square with the ordinates draw M'—L and P—Q; then parallel with the ordinates draw M—L and 1—Q. Now in Fig. 3 set off H—L, H—P, equal respectively with M'—L, and Q—P of Fig. 4. Parallel with the seat line draw L—M, P—Q. Then set off E—N and A—Q equal with H—M and H—Q above. Then square with the pitch lines D,—E, D—A draw E—O and A—R indefinitely. Then parallel with the plan tangents draw N—O and R—Q. Now in Fig. 4 with M' and 1 as centers, and E—O and A—R of Fig. 3 as radius, describe arcs in O, R. Then with 2 and M of Fig. 4 as centers, and the width of coping as given in 1—2 of plan as the radius, cut the arcs in R and O. Joining M—O and 2—R gives the position of a level line at the surface of the joint. Then O—M and R—1 square with them gives the position of plumb lines. The angles M—M'—O and 2—1—R may be transferred to any convenient part of the drawing, and the section of the joint surfaces developed in the manner fully explained for the like problem at other plates.

Chas. H. Fox.



CORNICE OF FIREPLACE
DOGES' PALACE, VENICE



DOOR HEAD AND ARCHITRAVE,
CHURCH OF STA. MARIA
MIRACOLI, VENICE.

SOME ITALIAN DETAIL—ABOUT ONE-SIXTH FULL SIZE.
Measured and Drawn by Wm. Raf, for Canadian Architect.

LIMESTONE INDUSTRY OF THE UNITED STATES *

THE following table shows the production of limestone in the United States in 1897. The total valuation, \$14,804,933, exceeds that of 1896 by \$1,782,296. This is a very substantial gain, but in view of the increase which has marked the production of other kinds of stone it is not at all surprising, and is a very satisfactory indication of returning prosperity in stone production:

Production of Limestone in 1897, by States.

State.	Lime.	Building and Roadmaking.	Flux.	Total.
Alabama	\$ 157,842	\$ 25,752	\$ 38,217	\$ 221,811
Arizona	11,522	.....	.....	11,522
Arkansas	30,890	13,332	.....	44,222
California	277,104	17,894	13,927	308,925
Colorado	11,970	2,971	64,315	79,256
Connecticut	177,702	.....	708	178,410
Florida	16,636	2,253	.....	18,889
Georgia	27,000	.....	5,000	32,000
Idaho	12,760	2,778	.....	15,538
Illinois	228,220	1,213,291	41,646	1,483,157
Indiana	173,750	1,716,461	122,397	2,012,608
Iowa	104,163	376,409	.....	480,572
Kansas	8,971	199,918	.....	208,889
Kentucky	6,583	27,943	6,289	40,815
Maine	742,877	.....	.....	742,877
Maryland	165,165	16,472	.....	181,637
Massachusetts	113,809	11,726	973	126,508
Michigan	145,280	67,534	2,363	215,177
Minnesota	61,187	175,210	.....	236,397
Missouri	404,885	605,445	7,872	1,018,202
Montana	12,750	.....	24,550	37,300
Nebraska	400	21,446	20,513	42,359
New Jersey	108,195	2,170	31,281	141,646
New York	555,050	1,074,214	68,516	1,697,780
Ohio	877,167	462,209	147,174	1,486,550
Pennsylvania	1,038,723	580,383	708,764	2,327,870
Rhode Island	11,555	.....	.....	11,555
South Carolina	30,000	.....	.....	30,000
South Dakota	1,895	2,000	.....	3,895
Tennessee	76,037	35,609	2,128	113,774
Texas	21,862	14,816	20,580	57,258
Utah	3,877	116	5,257	9,250
Vermont	164,960	697	.....	165,657
Virginia	101,424	27,852	63,696	192,972
Washington	122,317	.....	4,560	126,877
West Virginia	57,328	3,183	1,035	61,546
Wisconsin	311,355	328,759	1,118	641,232
Total	6,373,211	7,028,843	1,402,879	14,804,933

*Extracts from Report of Prof. Wm. C. Day, to United State Geological Survey.

THE INDUSTRY IN EACH STATE.

The following is a consideration of the limestone industry in the various productive states:

Alabama.—Production increased from a value of \$180,921 in 1896 to \$221,811 in 1897. The increase was due to a greater production of lime and of flux for blast furnaces. The amount used for building and road making declined.

Arizona.—There was a slight falling off in the production in 1897, but it is hardly significant, as the industry in this state is as yet small at best.

Arkansas.—Production increased from \$30,708 in 1896 to \$44,222 in 1897.

California.—A decided increase in output marks 1897 as compared with 1896 in California. The value of the product in the former year was \$143,865; in 1897 it was \$308,925. Stone production all over the state has very materially improved during the past year.

Colorado.—The value of the output in 1896 was \$65,063; the figure for 1897 was \$79,256. A slight increase is evident.

Connecticut.—Production increased from a valuation of \$138,945 in 1896 to \$178,410 in 1897. Practically all the product was burned into lime, of which the above figures represent the value.

Florida.—This state produced very little or no stone of any kind except coquina until a few years ago. In 1896 the value of the limestone output was \$16,982; in 1897 \$18,889.

Georgia.—Production increased somewhat in 1897, the value for this year being \$32,000.

Idaho.—Production increased from a valuation of \$5,662 in 1896 to \$15,538 in 1897.

Illinois.—The limestone industry in Illinois has always been a large and important one. A few years ago the state stood first in output of limestone for building, but in 1896 and 1897 Indiana has taken first place. Most of the limestone produced in Illinois goes for building purposes. Full accounts of the quarrying operations at the Lemont and Joliet quarries have been given in former reports. The value of the product in 1897 was \$1,483,157; in 1896 the corresponding figure was \$1,261,359.

Indiana.—The value of the limestone output in Indiana reached the highest figure since 1891, when it was very little more than that for the past year, for which the value was \$2,012,608. Of course the Bedford oölitic limestone contributes the bulk of this output.

Iowa.—The value of the limestone output in 1896 was \$410,037; in 1897 the corresponding figure was \$480,572. The quarries of Iowa are in general small, but the aggregate makes an industry of considerable magnitude.

Kansas.—Better conditions have prevailed in the stone business of this state in 1897, as the value of the output increased from \$158,112 in 1896 to \$208,889 in 1897. Most of the producers speak in much more cheerful vein than for some years past.

Kentucky.—Business was not so good in 1897, for which year the output was valued at \$40,815, considerably less than for 1896. However, during the latter part of the past year indications were decidedly better.

Maine.—A few years ago, and notably in 1892, the production of limestone at Rockland and vicinity was an industry of much greater magnitude than at present. The decline has been simply on account of hard times, and judging from gains made during the past year the old status will be regained before long. The output for the state in 1896 was valued at \$608,077, and for 1897 at \$742,877. Practically all of the value represents the lime made at and near Rockland, which has made a national reputation for the quality and abundance of pure limestone there found.

Maryland.—In Maryland, as in few other states, the limestone industry seems to be lagging behind somewhat in the return to prosperity, as the value of the product of 1896 exceeds that of 1897; but conditions in the early part of 1898 were undoubtedly better, judging from the statements made by some of the leading producers. A large amount of oyster-shell lime is made in Maryland, and this competes with the limestone quarrying.

Massachusetts.—The value of the product in 1896 was \$118,622; in 1897, \$126,508. A slight gain is evident. The most abundant stone in Massachusetts is granite, and limestone quarrying has never been prominent.

Michigan.—The value of the output in 1896 was \$109,427; in 1897, \$215,177 or nearly twice the figure for the former year. Business was in every way better than in 1896. Most of the product is burned into lime.

Minnesota.—There was an increase from \$228,992 in 1896 to \$236,397 in 1897, a difference not large enough, however, to have much significance.

Missouri.—The limestone industry of Missouri is one of considerable importance. While the value of the output is still considerably below that of 1890, it is an increase over the figure for 1896, for which year the output was valued at \$802,968; while in 1897 the valuation was \$1,018,202. The product is about equally divided between building and burning into lime.

Montana.—Production fell off from a valuation of \$83,927 in 1896 to \$37,300 in 1897.

Nebraska.—Limestone quarrying has never amounted to much in this state, but a large advance was made in 1897, when the product was valued at \$42,359, about four times the figure for 1896.

New Jersey.—In 1896 a valuation of \$134,213, and in 1897 that of

\$141,646, show that better conditions have prevailed during the past year.

New York.—This state produces in greater or less quantity every kind of stone known to the trade. Its limestone output increased from a value of \$1,591,966 in 1896 to \$1,697,780 in 1897. About two-thirds of the product is used for building and road making, while the remainder is nearly all burnt into lime.

Ohio.—The stone output of Ohio is divided between sandstone and limestone, both of which are quarried in large amounts. The value of the limestone product in 1896 was \$1,399,412; in 1897, \$1,486,550. The product is used for lime burning to the extent of nearly two-thirds, while something like one-third is divided between building, road making, and blast-furnace flux.

Pennsylvania.—Numerous comparatively small producers of limestone in this state aggregate annually a large output. This, in 1896, was valued at \$2,104,774, and in 1897 at \$2,327,870. A little less than half of the product was burned into lime, which is extensively used as a fertilizer, while the remainder was divided between blast-furnace flux, building and road making. The amount devoted to blast-furnace flux increased quite decidedly in 1897.

Rhode Island.—Very little limestone is produced in this state. It is all used for burning into lime.

South Carolina.—Thirty thousand dollars' worth of lime was manufactured from limestone quarried in the state during 1897. This output is slightly greater than that of 1896.

South Dakota.—Only about \$4,000 worth of stone, used mainly for building, was quarried in 1897.

Tennessee.—The limestone product of 1897 was valued at \$113,774. This figure is somewhat less than the value for 1896. Most of this represents the value of lime made.

Texas.—Production of limestone and lime fell off somewhat in 1897, when the product was valued at \$57,258. The product is equally divided between lime and blast-furnace flux.

Utah.—About \$10,000 worth of lime and limestone for flux was yielded in 1897. The output has never been large.

Vermont.—Production increased from \$147,138 in 1896 to \$165,657 in 1897. All the product was burned into lime.

Virginia.—The value of the output in 1896 was \$182,640; in 1897, \$192,972. Most of the product is burned into lime.

Washington.—Production increased from \$83,742 in 1896 to \$126,877 in 1897. Practically all of this value represents lime made.

West Virginia.—Production in 1896 was valued at \$59,113; the figure or 1897 was \$61,546.

Wisconsin.—The limestone industry of this state is an important one and likely to become still more so as western population increases. Most of the limestone quarried is converted into lime, which bears an excellent reputation to a greater than merely local extent.

SANDSTONE INDUSTRY OF THE UNITED STATES.*

The following table shows the output of sandstone in the United States for the year 1897:

Sandstone Production in 1897, by States.

State.	Value.	State.	Value.
Alabama.....	\$ 3,000	Missouri.....	\$ 57,583
Arizona.....	15,000	Montana.....	25,644
Arkansas.....	3,161	New Jersey.....	190,976
California.....	4,035	New York.....	544,514
Colorado.....	60,847	North Carolina.....	11,500
Connecticut.....	364,604	Ohio.....	1,600,058
Illinois.....	14,250	Pennsylvania.....	380,813
Indiana.....	35,561	Texas.....	30,030
Iowa.....	14,771	Utah.....	7,907
Kansas.....	20,953	Washington.....	16,187
Kentucky.....	40,000	West Virginia.....	47,288
Louisiana.....	8,000	Wisconsin.....	33,620
Massachusetts.....	194,684	Wyoming.....	11,275
Michigan.....	171,127		
Minnesota.....	158,057	Total.....	\$4,065,445

THE INDUSTRY IN THE VARIOUS STATES.

Alabama.—But little sandstone quarrying was done in 1897, but indications are more encouraging for 1898.

Arizona.—Production amounted to \$15,000, a slight increase over 1896.

Arkansas.—But little was done in 1897; a number of quarries were shut down for the year or a large part of it.

California.—Production was small in amount for 1897.

Colorado.—The value of the output in 1896 was \$58,989; in 1897, \$60,847. Indications for the future are better, on the whole than for several years past.

Connecticut.—The value of output in 1896 were \$426,029; the figure for 1897 was \$364,604. There has evidently been a decline, but prospects for 1898 are said to be better. Most of the sandstone comes from the neighborhood of Portland, Cromwell, and just across the river from Middletown. A full and exhaustive statement of tests and analyses of the Portland sandstone quarried by the Brainerd, Shaler & Hall Quarry Company and the Middlesex Quarry Company was made in the report for 1896.

*Extract from Prof. Wm. C. Day's Report for 1897 to the United States Geological Survey.

The stone quarried at East Haven is a rather unique sandstone, being composed of granitic constituents and requiring methods of quarrying resembling those applied to granite rather than ordinary sandstone. It is a hard, durable stone, used freely in New Haven and vicinity in buildings and in bridge work. A church at East Haven built of this material over a hundred years is apparently unimpaired to-day.

The sandstone industry of Connecticut has long been one of general interest because of the popularity of the Portland sandstone for use in fronts of pretentious buildings, notably residences in New York, Boston, Philadelphia, and other large Eastern cities.

The quarries at Portland and vicinity are worked upon a large scale, and by firms possessing ample capital and extensive plant. There is a very large percentage of waste material handled at these quarries, and much care is exercised in selecting the best material only for use in building. This fact necessitates handling enormous quantities of stone, and to do this economically the best and most modern devices for lifting and shifting large masses must be used, so that liberal capital must be invested or the work becomes too expensive to pay. The Brainerd, Shaler & Hall Quarry Company represents the consolidation of a number of concerns with extensive capital. The Middlesex Quarry Company and New England Brown Stone Co. are their important concern. Private railways, powerful derricks, and what is probably the largest traveler in the country, if not in the world, are to be found here.

A slaty-looking material, known to the quarrymen as "shell," is abundant and must be avoided; the same material occurs in the sandstone at East Long Meadow, Massachusetts.

The method of quarrying is simple, and adapted to the production of large blocks at a minimum of expense. Large blocks are loosened out by the Knox system of blasting, and then men working together in gangs pry the blocks out so that a chain may be hooked around them, by which they are hoisted from the quarry by derricks. The teams of oxen formerly used for hauling stone have almost entirely disappeared, their work now being done by steam. The stone is shipped largely in the rough. The work of squaring blocks is done by dealers using saws and chilled iron as the abrasive material, although a few diamond saws are also in use. Rubbing is accomplished by lowering the stone upon a revolving iron disk, upon which sand and water are continually fed.

Illinois.—The production of sandstone was about the same in point of value for the last two years. Comparatively little sandstone is produced. Most of the quarries of the state produce limestone, and, as may be seen from the limestone report, the output is very large.

Indiana.—Sandstone quarrying in Indiana is, as compared with the limestone industry of the state, of much less importance. The value of

the sandstone output in 1897 was \$35,561, a slight increase over 1896.

Iowa.—Limestone quarrying in this state constitutes the chief part of the stone industry of the state, sandstone production being comparatively small. The value of the sandstone product in 1897 was \$14,771. Most of the quarries of the state are small, but there is a large number of them.

Kansas.—The output from a number of comparatively small quarries in 1897 amounted to \$20,953, slightly more than in 1896.

Kentucky.—Sandstone valued at \$40,000 was produced in 1897.

Louisiana.—A small quantity of sandstone was quarried for riprap in jetty construction.

Massachusetts.—There was a decided falling off in sandstone production, namely, from \$304,361 in 1896 to \$194,684 in 1897. The most important quarries are those of East Long Meadow, the output of which is well and favorably known as the result of years of experience in building.

Michigan.—The value of the output increased \$111,321 in 1896 to \$171,127 in 1897. The sandstone of Michigan is coming more and more into use over a considerable area of the United States.

Minnesota.—Production fell from a valuation of \$202,900 in 1896 to \$158,057 in 1897.

Missouri.—The value of the output in 1896 was \$51,144; in 1897, \$57,583. When the general business interests of the country have again reached normal conditions production will probably increased.

New Jersey.—The value of the output in 1896 was \$126,534; that of the product in 1897 was \$190,976. An increase in output is evident, and the industry seems to be on a more substantial basis than for several years.

New York.—The sandstone industry in New York State is of special interest on account of the fine quality of the stone taken from a number of its prominent quarries. The stone is well known to builders and experts. The output of 1896 was valued at \$223,175, while that of 1897 amounted in value to \$544,514.

The increase in output is due in some degree to the use of stone in repairs and changes in the Erie Canal.

North Carolina.—The output of sandstone in 1897 was valued at \$11,500. This is slightly below the value of the product of 1896.

Ohio.—The sandstone industry in Ohio is a large and important one. The value of the output in 1892 was \$3,300,000; since that year, however, owing to the general depression in business, this high figure has not again been reached. The value of the output in 1897 was \$1,600,058.

The stone is used for a wide range of purposes, including building, flagging, curbing, grindstones, whetstones, etc.

Oregon.—This state produced sandstone to the value of \$35,000 in 1892,

but since that time little has been done. The value of the output in 1897 was very small.

Pennsylvania.—The value of the sandstone output in 1896 was \$446,926; the corresponding figure for 1897 was \$380,813. A full account of the sandstone of Pennsylvania was published in the report for 1896.

South Dakota.—Very little sandstone was quarried during 1897.

Tennessee.—Almost nothing was done in sandstone quarrying during the past year.

Texas.—The value of the sandstone output of 1897 was about the same as in 1896; for 1897 the value was \$30,030.

Utah.—A small output was secured during the year.

Virginia.—Very little sandstone was quarried in 1897.

Washington.—Production increased from \$11,090 in 1896 to \$16,187 in 1897.

West Virginia.—Production increased from a valuation of \$24,693 in 1896 to \$47,288 in 1897. Business is generally reported as improving throughout the state.

Wisconsin.—The value of the output in 1896 was \$65,017; in 1897, \$33,620.

Wyoming.—Production fell off from \$16,465 in 1896 to \$11,275 in 1897.

HIGH WINDS AND SKY-SCRAPERS.

WHILE the winds were blowing in Chicago the other day at the rate of 40 or 50 miles an hour, it was noticed with alarm by the occupants of some of the tallest of the sky-scrapers that the clocks were stopped by the vibration of the structures. This demonstration of the power of the wind has set the people to thinking and they have begun to appreciate the danger of running their business blocks into the air to the twentieth story. It is not likely that a well-built steel building, even at this excessive height, would readily succumb to the wind pressure. But the trouble is that there is no such guarantee of good construction as to insure against collapse.

The wind sometimes blows at twice the rate just experienced in Chicago. During the St. Louis cyclone of a few years ago it moved as fast as one hundred miles an hour. The tearing, twisting, destroying force of the wind when it reaches these high velocities is as yet but feebly estimated. Its effects are seen, its powers are dreaded. The worst feature of the wind storm is that it does not blow in steady pressure, which might be safely withstood even when the rate approaches the known maximum. The wind takes sudden spurts of intense ferocity, and, swirling, doubling and smashing, it achieves unmeasured power in the course of a few seconds sufficient to destroy the strongest structures. As a rule the high building is constructed with careful reference to its capacity to resist the wind. Yet danger is inevitably to be encountered when the roofs are sent skyward, as in Chicago, New York, and some other large cities.—American Contractor.

Art of Producing Photographs in Color.

Specification forming part of Letters Patent No. 611,457, issued September 27, 1898, to James W. McDonough, of Chicago, Ill., assignor, by Mesne assignments, to the International Color Photo Company, of Jersey City, N. J.

This invention has excited general interest, and been the subject of much comment in scientific circles. Should the process described prove in practice all that is claimed for it, it will be of very great usefulness in the industries represented by this journal.

In the drawings, Figure 1 represents the invention when embodied in a plate having parallel alternating different-colored lines. Fig. 2 represents the same when the plate is provided with alternating lines of colored dots. Fig. 3 represents the same when the plate is provided with the seven primary colors of the spectrum recurring in their regular order of sequence. Fig. 4 represents the same as Fig. 3, with the addition of transverse black lines. Fig. 5 represents the same when the plate is provided with alternating red and blue lines, crossed transversely by yellow lines, forming with the red at the intersection orange dots or squares and with the blue green dots or squares. Fig. 6 represents the same as Fig. 1 except that the lines are arranged in waving or curved order. Fig. 7 represents the same when the plate is provided with a different arrangement of dots or squares from that shown in Fig. 2, and Fig. 8 represents the same when the plate is provided with alternating zigzag lines of different colors.

The inventor says that while he has represented in the drawings described above a number of different patterns in which his invention or process can be embodied, he desires it to be distinctly understood that he does not limit himself to these special patterns, as it will be apparent from the description of the invention and process, hereinafter given in detail, that the same can be embodied and carried out through an almost infinite variety of patterns or arrangement of the colors employed.

In making the improvements, including the process employed, he takes a glass or celluloid plate, upon the face of which are deposited small particles of colored

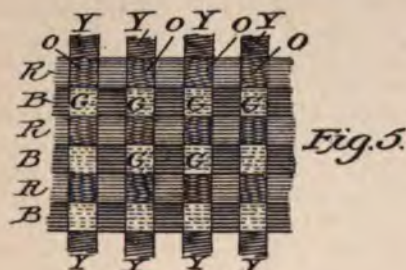
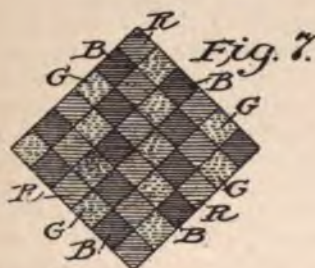
mediums—shellac, gelatin, or other medium—colored with anilin dyes to correspond with the fundamental colors of the spectrum—say reddish orange, yellowish green, and violet blue—or upon the face of which are ruled separate fine alternate lines in colors in the order of the spectrum, or upon the face of which are placed small alternated dots or squares in any manner sufficiently close to present to the eye a neutral surface. This plate may be varnished, or the screen may be built up of separate thin layers upon which a single color is lined or placed and then cemented together. The color of each is preferably of such depth as to absorb the kind of light transmitted by both the others. More than three colors in the dots or lines or figures may be used, such as the complementary colors red and green and blue and yellow, or the whole series of the spectrum. Such a mixture of colors placed side by side follows the laws of the mixture of lights and not of pigments.

The screen or plate is placed in a photographic camera and in contact with an orthochromatic sensitized plate for the purpose of taking a negative and in such manner that the light from the object to be photographed shall pass through the multicolored screen. There are different grades and qualities of orthochromatic plates, and it is preferable to use such as are susceptible to the action of all the colors of the spectrum, or such as are needed in the picture to be taken. A plain colored screen may be used in connection with the multicolored screen to retard the action of some actinic rays that act more readily than others, or the depth of color, or the width of lines, or the size of dots or figures may be such as shall adapt themselves to different degrees of sensitiveness to actinism of the particular orthochromatic sensitized plate used.

The negative taken through a lined screen is in lines corresponding with the action of the colored light through the lines of the screen which do not absorb its particular color. In other words, blue light will act through the blue lines and be absorbed by its neighboring red

and green lines, red through the red lines, etc. The sensitized film may be applied directly to the multicolored screen or plate and stripped off after development in the manner well known and used

or figures corresponding to the first plate or screen, preferably of somewhat lighter tints or shades, but so as to register with such plate or screen in color and place. With the opaque paper or celluloid

Fig. 1.*Fig. 2.**Fig. 3.**Fig. 4.**Fig. 5.**Fig. 6.**Fig. 8.**Fig. 7.*

as a negative. A corresponding multi-colored plate of glass, opaque white celluloid, paper, or other material suitable for the purpose is then made upon which is placed colored particles in dots or lines

opaque printer's ink may be used instead of the transparent colors, and the light and color are reflected instead of transmitted. Lines are preferred on account of the facility of making them register,

while dots or figures are preferred on account of the more even surface presented to the eye. The one or the other may therefore be used, according to the particular result sought to be accomplished. Lines, dots, or figures may be printed, placed, or ruled upon the paper or material used. These lines or particles follow the laws of stippling or true mixture of lights and present a surface white or neutral gray, according to the purity of the colors, cleanliness of mixture, and amount of light absorbed and reflected. This material is called "printing-paper," as the paper or other material, colored as described, may be covered with albumen or gelatin sensitized with silver and printed upon through the negative or by a metal or glass "half-tone plate" or type in a press with printer's ink.

For the purpose of printing on a mechanical press a photographic negative is made by means of the multicolored screen—say such a one as is ruled or printed in the alternated lines above, one hundred to the inch of each color, or three hundred to the inch of all—one colored line to transmit reddish orange, the next yellowish green, the next violet blue, and so on in alternation, or, in other words, an approximation to the recognized fundamental colors of the spectrum. This negative will be in lines opaque where the colored light has been transmitted and transparent where it has been absorbed. From this negative is made a metal or glass half-tone plate by any of the usual methods. This half-tone plate is divided on its surface by these manipulations in alternate raised lines, each corresponding to the amount of color absorbed by the colored lines of the screen or plate in the camera, or, in other words, to the non-action of light on the sensitized photographic plate, the depressions corresponding in width to the amount of light affecting the sensitized plate of the negative. A print taken from this half-tone plate upon white paper will show with black ink a lined black and white picture, or where dots and figures are used it will show a black and white picture corresponding to the pattern.

In order to print a colored picture, take a sheet of printing-paper, as described heretofore, containing the colored lines, dots, or figures corresponding to the screen and negative, and to which the half-tone printing-plate also corresponds in register, and print upon it, by means of the half-tone plate, a black or dark ink, making it register, so that the black ink will cover to its proper degree the colors which were absorbed in the camera by the compound colored plate or screen and leave uncovered or exposed those colors whose corresponding colors in the object to be photographed have impressed themselves upon the negative in the camera. The blacks are formed by the black ink, the whites by the combination of the colored lines, dots, or figures not covered by the ink and intermediate mixtures of colors by the combination of such colored lines, dots, or figures as are not entirely covered or obscured.

Hard Blow at Strikers.

Judge Hammond, of the United States Circuit Court, Cleveland, O., granted the application of the American Steel and Wire Company for an injunction against the striking wire drawers. The injunction is a blanket one, and applies to all the defendants named in the petition, and to any others who may hereafter interfere with the employes of the company.

The court held that those seeking employment in the place of the strikers have rights which labor unions and strikers are bound to respect, and that one of the rights of each citizen is that of unobstructed access to the place where the work is to be done and over streets and highways and usual approaches to such place, and that this freedom of access is not at all inconsistent with the right of strikers to use the same streets and highways for the lawful conduct and maintenance of their strike by peaceable entreaty or argument with men intending to supplant them in employment.

The injunction granted restrains the strikers from in any manner interfering with the operation of the complainants'

mills and from molesting or intimidating or threatening those desiring to work at the mills, and from congregating and picketing the mill or the houses of the employes for the purpose of intimidation.

Judge Hammond said that the right of labor is not only a right of property, but of liberty, which every man enjoys in this country as his birthright; that this liberty is not confined to political rights alone, but extends as well to personal activities in an about one's daily business, be he laborer or capitalist; that the right which the court enforces by injunction is the same right that lies at the foundation of the strikers' own freedom when they refuse to work on any terms but their own, and it is a right which no person, because he is a striker, can lawfully deny to the so-called "scab," who is entitled to pass freely through the streets and highways to his work. In this country the freedom to contract in business is a constitutional freedom, which not even state legislatures can impair, and certainly not strike organizations, for they surely cannot do lawfully what the legislature may not.

To the suggestion that few acts of violence have been shown, the judge said that most potential force or violence may exist without lifting a finger against any man or uttering a word of threat against him, and that the plan of campaign adopted here was a most substantial exhibition of force by keeping always near the mill large bodies of men, massed and controlled by the leaders so as to be used for obstruction if necessary. A skillful wire drawer, but a timid man, would be deterred by the mere knowledge of the fact from going to the mill when he desired to go and had agreed to go or was already at work, or make him fear to return to it through the streets where the men congregated, or, having started, he would turn back when fearing the trouble that might come of the attempt. Such a force, it is held, is violence within the prohibition of the law, and its exhibition should be enjoined as violating the property rights of the plaintiffs in the streets and their liberty of contract.

To the claim made that the mills were now employing foreigners the court tersely said that there is no distinction in this country in the legal rights of classes based on race or nationality, and all stand upon an equal footing in this respect.

The strikers' attorneys gave notice that they would enter a motion to take the case to the United States Circuit Court of Appeals.

The Subterranean Quarries near Maastricht.

The labyrinth of the Petersburg, near Maastricht, in Dutch Limburg, is a very interesting curiosity. Geologically the formation belongs to the Senonian chalk, and the Maastricht tuft, as it is called, consists of coarse grained, yellow marls, which resemble sandstone in appearance—the people talk of sand hence—and which are lined with rows of large flints always lying on their flat side. The marl forms a fair building material, which is very easily quarried. The quarries date back to the most remote ages, though it is not certain that what is to-day pointed out as a Roman or a Celtic quarry need deserve such a denomination. Of recent years the use of the marl has declined. Everybody had, in the middle ages, the right to quarry on his ground without having to pay any royalties. That is one of the reasons why the hill is so strangely honeycombed with passages that one may wander for days, it is said, without twice touching the same point. The marl is usually quarried in blocks 21 inches by 21 inches by 32 inches. A furrow is made, a wedge inserted, and the rest is done with the help of a steel saw. Houses built of these blocks have a neat appearance. After about fifty years the mauve yellow turns greenish gray; they can they be scraped and look tidy again. The walls are firm, but must not be knocked about. Yet ruins of old castles prove that the stones can stand a good deal.

MARBLE AND GRANITE



Ishpeming Marble.

Some day the marble range lying a few miles north and west of Ishpeming will be the scene of great activity, prophesies the Ishpeming (Mich.) Iron Ore. There is lying, awaiting the hand of man to bring to light, millions of feet and tons of beautiful verde antique marble than which a finer is not found anywhere. Its closest prototype is found in small veins in Greece, and there the ancient beds are well nigh exhausted. The little which has been done to call to the attention of the commercial world to the value of the Ishpeming marble range has not been sufficient to bring about the development of the deposits, or to secure the first order from those who are users of such material.

One everywhere finds marbles used for interior decoration which are greatly inferior to this; that are cold and dull in comparison, and cost much more to place in the market than ours could be secured for. There would be no difficulty in quarrying blocks as large as could be profitably sawn, and of any size required for pillars and large shapes such as modern architecture displays. Even at surface, where the rock has for ages been exposed to the elements, there is a wonderful freedom from fracture. Many who are unfamiliar with marbles of this class and such as are used for interior purposes, have looked upon the veining of the verde antique as objectionable, and many have pronounced it imperfect on account of this jointed structure. It is by reason of this very fact that the marble is so readily recognized as the verde antique, and it is furthermore true that all marbles in which there is so perfect a blending of color as in those of the

Michigan field have this same veinous appearance. The ignorant ones persist in calling these markings "cracks," whereas they are the firmest portion of the rock structure. To the educated in in marbles the veinous pieces are the most beautiful. Similar structure is shown in the costly onyx and in all of the richest colored marbles.

In Detroit we recently paid a visit to the custom house and postoffice building, a beautiful one, and in the spacious corridors of which marble is plentifully used as wainscoting. It was of brownish color, probably from Tennessee, and would present a very shabby appearance as compared with the verde antique of the Ishpeming range. The marble was examined by several gentlemen from the upper peninsula, and all were sorry that an Ishpeming product could not have been used. It would have been a fine place to have advertised it, and it would have added much life and beauty to the interior finish of the building.

This marble is one of the several undeveloped mineral treasures yet to become prominent in Michigan. In the opening and working of a marble quarry much money is needed. There would have to be an extensive plant of machinery and some little time would be necessary in order to clear off the surface portion of the deposit, so that the drills and channelling machines could find solid ground. The rock is homogenous, is easy to cut and takes on a wonderful polish, due to its fine grain. There is no cleavage as in the case of many rocks. There is a great variety of coloring, this differing at certain portions of the range, but there would be no trouble in securing any amount of marble of one general hue. The variety of shade from the

dark greens to the light greys and browns makes the product all the more desirable, as the different kinds could be admirably used in different rooms of a building if it were so desired.

The addition of such an industry would be of great importance to this district. Worked upon such a scale as the beauty of the material demands it would require the services of many hundred men. The range productive of this marble is not an extensive one in miles of formation, but upon lands where it occurs there is an abundance of it, some of the outcroppings being of great size. When these quarries are wrought, as some day they will be, it will make of Ishpeming a most active town and bring it greater population and wealth. Each citizen should do his mite in bringing the marble deposits to the attention of those interested in such mineral.

Egyptian Sepulchral Tablets.

These tablets, "huta," were used for the same purpose as tombstones and sepulchral monuments at the present day, but distinguished by having been placed inside the tombs and not outside and in the open air. They are different materials, as granite, sandstone, alabaster and limestone, and of different sizes and shapes, square, rectangular, and either pointed or rounded at the top; those of square shape often representing the entrance or cornice. At a later period (about the twenty-second dynasty, or in the ninth and eighth centuries B. C.) wooden tablets made of sycamore were substituted. These tablets are generally rounded above, and surmounted by a wooden figure of the baieth, or soul, and stand on a pedestal of two small flights of steps, into which they are inserted. They have been covered with linen, coated with plaster, on which have been painted in tempera the vignettes, or pictures, and inscriptions. The principal subjects represent the deceased attended by his mother, wife, sister, or brethren standing in adoration to the boat of the Sun, or to the solar deities Ra, Sekar or Socharis Tum, Atum or Tomos, and Osiris, either alone or ac-

companied by his wife Isis; Nephthys, Anubis, Amset, Hapi, Tuautmutf and Kabhsenuf, and other sepulchral deities. The texts accompanying these scenes are the names and titles of the deities and of the deceased, usually placed in the scene along with them, and a larger inscription in horizontal lines of hieroglyphics, placed under the scenes, being a proscynema or act of adoration to the principal deities to confer the usual benefit of food, permission to pass from Hades or off the earth, and for the soul to go to heaven or the empyreal regions. Some inscriptions are adorations or hymns to the sun. The name of the deceased on these tablets is preceded by the title of Osiris, in whose condition he was supposed to pass after death; but about 100 B. C. females began to have the titles of Athor, or the goddess of beauty, prefixed to their names. Some of the tablets were surmounted on the rounded top by the figure of a human-headed hawk, emblem of the bai or soul, fixed by a plug into the upper rim of the tablet.

A Granite Foundry at Last(?)

A Canadian genius claims to have discovered a method of casting granite in a mold. The only secret about it he says is in the construction of a furnace melting the stone. The molds are prepared in damp sand in the same manner as for iron or steel molding, and the liquid granite is poured in from ladles. The inventor claims that he can produce columns and fancy cornice pieces cheaper than rough blocks of stone cost delivered at an operation. This is possible because he utilizes the shippings and waste stone about a quarry.

Marble for Partitions.

Economy in space and in money can be served by the use of marble for partitions, especially for divisions in ranges of water closets, shampooing rooms, or bath rooms. A marble slab, polished both sides, has only to be supported by framing top and bottom to make a di-

viding wall complete, and nothing more is necessary—the wall is built and finished at once. The saving in space is at once apparent. A 4½-inch brick wall becomes 6-inch or 7-inch, at least when the plastering is taken into account; an 1-inch polished slab will answer every purpose. Then in the matter of cost a dividing wall composed of a polished slab of marble is absolutely cheaper than a brick wall plastered. It has only to be fixed to be complete in itself.—Stone-mason.

Peoria, Ill., will erect a monument to the memory of Yeoman Ellis, the only man killed in the naval fight off Santiago.

The Memorial Committee of the Houston Club, of Philadelphia, has decided to erect a memorial gate at a cost of \$5,000 to the soldier-students of the University of Pennsylvania.

PERSONAL.

W. N. Caldwell, Bowling Green, O., who has been employed in McCaully's marble shop for a number of years, has decided to go into business on his own account.

PROPOSED MONUMENTS.

The One Hundred and Twenty-third Ohio volunteer infantry have taken steps for the raising of enough money to erect a monument in the cemetery at Winchester, Va., to commemorate the deeds of the fallen members of the regiment.

Two hundred dollars have already been raised for this object. Col. C. M. Keyes, of Sandusky, is president.

MONUMENT.

Cambridge, Mass.—A mass meeting of Harvard students and graduates was held to take measures for the erection of a memorial to the Harvard men who died in the Cuban war. President Elliott warmly advocated some form of memorial, but urged time for consideration of the form the memorial should take. The meeting embodied its desire for a memorial in a resolution, passed unanimously, for the appointment of a committee to take immediate action.

A movement is now on foot to erect to the memory of the late William G. Westall, engineer on the Gulf road, who lost his life for the sake of 200 passengers, near Dome Rock, a monolith of granite, to be placed near the spot where Westall's heroic deed was done. Union lodge, A. O. U. W., of Denver, Col., started the fund, to which lodges of this order from all over the state will contribute. The monument, suitably engraved, will be erected between Dome Rock and Buffalo park in Platte canon, where on August 29, Engineer Westall stayed with his engine to save the lives of his passengers. The idea of the monument was taken from the Garfield monument of the Durango line of the D. & R. G., which was erected by some commercial travelers when news of the death of the martyr president was received.

CEMENTS AND LIMES.



Lime Kiln.

Specification forming part of Letters Patent No. 611,402, issued September 27, 1898, to Edwin V. Wingard, of Philadelphia, Pa.

This invention has relation to improvements in lime kilns; and the objects are to simplify and improve existing constructions and devices made for the purpose of reducing limestone to lime by providing a lime kiln with an improved cooling-chamber, increase the production capacity, and insure the durability of the kiln, and generally to improve and perfect the general construction and utility of the kiln.

Figure 1 is a sectional plan taken on the line 1 1 of Fig. 2. Fig. 2 is a central vertical section on the line 2 2 of Fig. 1.

A designates the base of the kiln, made up of the usual masonry, having built or formed therein the furnaces 3 4 5 6, duplicates in construction and arranged at right angles to each other, as shown in Fig. 1 of the drawings. These furnaces occupy the upper portion of the base structure and are roofed in by arched tops 7 and provided with grate-bars 8, the fronts or openings thereto being closed by substantial metal doors 9. At the rear of each furnace is a vertical fire-wall or pier 10, rising from the bridge-wall of the furnace to the arch of the roof and located intermediate of the opening to the cupola to serve as a support for the furnace roof at this point, a deflector for the flames into the cupola, and as a shield to prevent the products of the kiln from falling outward into the furnaces. At the inner end of each furnace is a bridge 11, having the upper face inclined from the top downward and inward, as seen at 12, and in the masonry of each furnace is formed a cold-air slot or opening 13, opening into ways 14, leading into the furnaces adjacent to the base of the arches thereof, as shown in the drawings. The main slot 13 has any suitable opening through the outer face of the wall to admit the air, as indicated in dotted lines in Fig. 1 of the drawings, the purpose being to admit the outside

air to increase combustion and prevent smoke accumulations. In the interior faces of the base or cooling-chamber of the kiln, below the furnaces, substantially midway of the height of the base, the bricks or masonry at intervals are laid or placed to extend inward beyond the faces of the main walls, as shown, forming elongated vertical projections 15, arranged parallel with each other to prevent the burnt lime from falling down, as it otherwise would do were not these obstructions interposed, and to hold the burnt material in the cooling-chamber or space above the pit and below the action of the furnaces until cooled and ready for discharge and withdrawal. Under one of the furnaces is formed an opening, as 16, to admit a wagon, cart, or car, into which the lime can be loaded immediately from the burnt charge as it descends. If a car is used, a track 17 can be laid on the floor of the base whereon the car can be run.

Mounted on the furnaces is the cupola B, built of an inner substantial lining of fire-brick 18, an outer wall of red brick 19, and a covering of strong boiler iron 20, substantially as seen in the drawings. At determined distances in the cupola are formed apertures 21, opening through the walls and made flaring from the point of entrance to their opening into the cupola. These apertures 21 afford means for examining the condition of the contents of the kiln to ascertain the progress of reduction; and should the lime become "bridged" or clogged in the cupola a bar can be passed in the cupola through the apertures and the contents loosened up and made free to pass on down the cupola. The interior of the kiln at the base and lower portion is square with rounded corners, as at 22, and above the furnaces the cupola is round and conical from its base to the top, as indicated in the drawings. The conical construction permits the lime to gradually fall down without material obstruction, and yet does not leave the contents to fall faster

Fig. 1

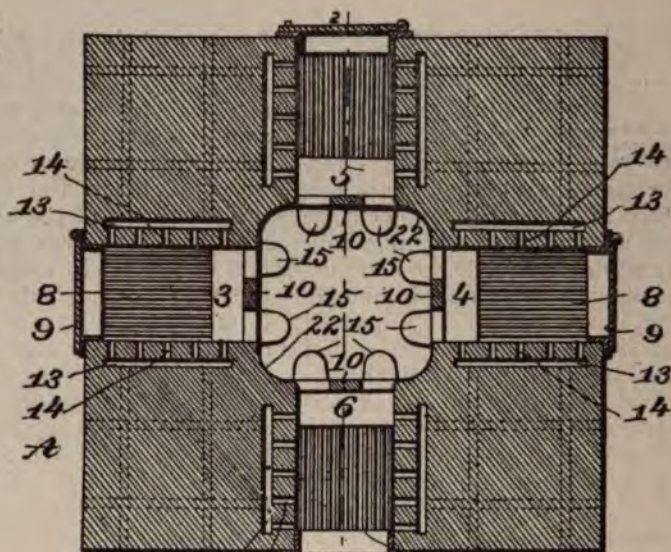
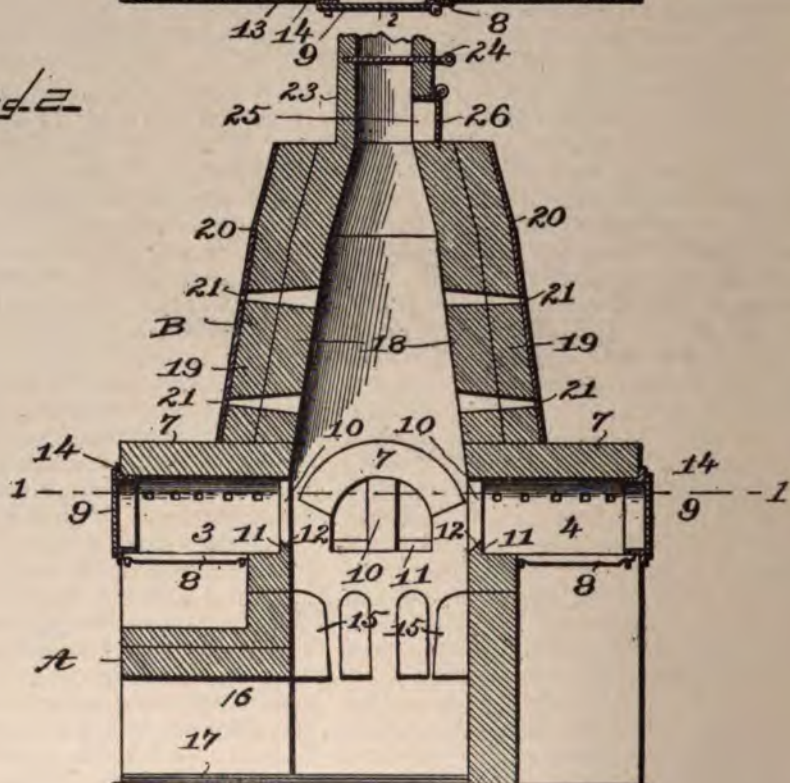


Fig. 2



than perfect combustion is completed.

On the top of the cupola is built or erected the stack 23, reaching to such height as may be determined by the capacity of the kiln and the draft to be required. In the stack may be a suitable damper 24 to regulate the draft, and at the base of the stack is an aperture or opening 25, through which the stock is supplied to the kiln, the opening 25 being closed by a suitable door, as 26.

All the furnaces may be used at once or three of them, according to the expedition required in the reduction of the raw material, the arrangement of the furnaces at right angles to each other being adapted to throw the heat at the points most desirable, and this particular construction of the kiln being such that complete reduction of the material is insured.

In the use of this improved kiln the charge is made by filling up the base to a line adjacent to and below the bridge-walls of the furnaces with earth or other suitable material, and then supplying the charge of limestone through the door at the top of the cupola. The fires are then started, and when the burning of that part of the charge subjected to the flames of the furnaces is completed the earth filling in the base is removed and the reduction proceeds. The limestone is reduced or burnt, descending gradually, and the limestone in the upper part of the cupola continually presenting a new supply to the action of the furnaces for reduction.

Concrete Footings.

For an ordinary two-story brick dwelling, footings six inches thick formed of good concrete will be found quite sufficient to support the building, particularly if the footings are five or six feet below the ground line, similarly as shown in Fig. 1. Here the footing is formed of six inches of concrete, well rammed in place, and allowed to stand twenty-four hours before the stonework is laid upon it. Concrete for footings should be mixed in the proportion of one part of cement to two parts of sand and four of stone for natural cements, and one to

two and one-half and five and one-half for Portland cement. The most satisfactory method of mixing concrete by hand is to first prepare a tight floor of plank, or better still, of sheet iron with the edges turned up about two inches, for mixing the materials on. Upon this platform should first be spread the sand, and upon this the cement. The two should then be thoroughly and immediately mixed by means of shovels or hoes, and the broken stone or aggregates then dumped in on top and the whole worked over dry with shovels, and then worked over again while water is added from a sprinkler on the end of a hose, or from an ordinary watering can. Only as much water should be added as is neces-

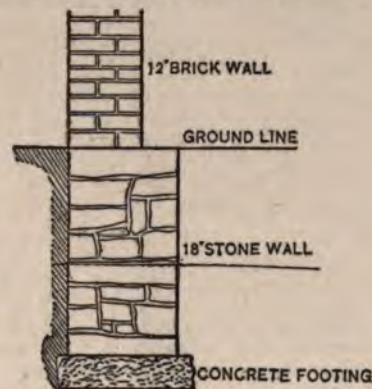


FIG. 1.—FOUNDATION.

sary to cause the cement to completely coat and cause to adhere all the particles of the aggregates. Too much water will lessen the strength of the concrete. The water used should be clean and at about the temperature of 65 degrees. As soon as a batch of concrete is mixed it should be dumped into the trench at once, but in no case should it be thrown more than four feet, for if dumped from a greater height the heavy particles are apt to separate from the lighter ones. The whole layer of six inches in thickness may be filled in at once, and where the thickness of the footings is to be more than six inches, two or more layers may be applied to make the required thickness, but the layers should never be more than six inches thick in any case. As

soon as a square yard of concrete has been deposited, it should be tamped with a wooden rammer weighing about twenty pounds. The tamping should be sufficient to just flush the water to the surface. The concrete should not be permitted to dry too quickly, and when there are to be two or more layers, and if twenty-four hours elapse between depositing the layers, the top of each layer should be sprinkled with water before the next is deposited. When good broad stones are scarce, it will be found much more economical to use concrete footings than footings of stone.—Canadian Architect.

Proposed Cement Trust in Japan.

Consul-General Gowey writes from Yokohama, August 31, 1898: As indicative of some new features of the course of trade in Japan, I inclose a clipping from the Japan Mail of yesterday, concerning the proposed organization of a trust by the leading cement companies of Japan:

THE CEMENT COMPANIES.

Japan, it seems, will not have to wait long for her era of "trusts," "railway kings," and the other outgrowths of modern commerce. We have seen how the cotton-spinning companies are combining to form a monster association for the purpose of reducing production and thus maintaining prices. It appears that the cement firms are about to adopt the same policy. There are ten cement firms in Japan. At one time they did a fine business, when railway building, harbor making, and other enterprises were in a state of feverish activity after the war. But they have felt the recent depression which affects all branches of business, and have come to the conclusion that their only plan is to combine for the purpose of putting an end to competition among themselves. Nine of the companies are said to have agreed to this course.

The Cement Market.

The increased demand for Portland cement has caused a scarcity of stock in the markets of the country. The stock on hand is variously estimated to be from one-quarter to one-third less than the actual need of consumption. This shortage has been developed through the extensive use of cement in the construc-

tion of buildings, bridges and pavements, and there has been a corresponding advance in price.

In an interview with the *Chattanooga Times* on the present supply of cement of domestic manufacture, the vice president of the Atlas Cement Company said: "The cause of the present shortage is due to some extent to the fact that there has not been the usual quantity imported, and the demand has to depend largely upon the amount manufactured here. The output in this country has not been sufficient to meet the requirements of builders and contractors. Although our factories are turning out more than they ever did before, we are behind in filling orders. The condition of the Chicago markets, reports from which indicate a decided shortage, are in no wise different from our own, but I do not think there will be any serious advance in prices."

The manager for the Alsen's Portland Cement Company said: "Our cement is all imported. The importations to this country last year reached 1,000,000 barrels. The total for this season will be smaller, on account of the fact that during the war very little cement was brought into the country. The imported article is higher priced than that manufactured here. There is about double the quantity used now that there was formerly. It is taking the place of lime and mortar in nearly all of the new buildings, and the uses to which it can be put in all construction work are rapidly extending the demand for it. I do not look for any marked advance in prices, however, nor do I think there is any cause to fear a famine."

PERSONAL.

John P. Bronson has resigned as manager of the Toledo White Lime Company, and will in the future manage the large rope factory at Monroe, Mich.

Clay C. Cooper, who for the past five years has been assistant managing and city editor of the *Detroit Journal*, has resigned to accept an important position with the Michigan Portland Cement Company.



American Roofing Slates in Denmark.

Vice and Deputy Consul Blom sends the following from Copenhagen, under date of September 9, 1898: "About two years ago, I called Danish importers' attention to American roofing slates, and have recently called upon the importers to hear their opinion. Building operations throughout the Kingdom are flourishing, and the supply of Welsh roofing slates is not sufficient for the demand; there is, therefore, a possibility of a market in Denmark for American roofing slates. Slate is not produced in Denmark, but is imported principally from Port Madoc, Wales, in the following sizes: 26 by 16, 24 by 16, and 24 by 12—all blue. Importers inform me that the American slate is inferior in quality to the Port Madoc, but that small lots are now being sold here. The freight rates from the United States to Copenhagen fluctuate between 17s. 6d. to 20s. (\$4.28 to \$4.86 per ton, which is considerably higher than by sailing vessel from Port Madoc; but the competition between steamship lines from New York to Copenhagen is getting keener, and lower freight rates can, no doubt, be secured.

"The principal importers are: Axel Prior, 33 Bredgade, Copenhagen; F. Gottlieb, 27 Tommerpladsgade, Copenhagen."

Slaters' Union.

We note with pleasure the formation of a union among the slaters in this section. They now realize what can be

effected by such an organization, and it is to be regretted that it was not done long since. It would have maintained a more uniform price in slate and thus benefitted employer as well as employee, and materially aided every business man in the region.

To the members of this union we would say: Let your demands be just and equitable, but insist on having them. Ask for your money every two weeks, and the laws of the state in which you live will sustain you. Allow no employer to dictate to you where to buy the necessities of life or any luxury you may wish to enjoy—it abridges your freedom. Buy where you can buy the best goods for the least money; pay cash and it will be a pleasure for business men in all lines to serve you. You can, if you will, revolutionize business methods in this section, and the coming generation will bless you.—Bangor (Pa.) Herald.

Slate or Shingles.

A correspondent of the Poultney (Vt.) Journal having raised the question as to the bearing strength of roof-work for slate and shingles, he was answered by one who had made a practical test of the matter as follows:

Editor Journal: In your valuable paper of October 7 I saw an article headed as above, thus recalling to my mind a transaction of twenty-eight years ago, soon after my arrival from the slate quarries of Pennsylvania. I went over to East Cambridge, found a large building in course of construction at the establishment of Messrs. John P. Squire & Co., pork packers.

It was to be their new ice house. I soon found that the roof was to be of shingles. I called at the office, found Mr. Squire himself, introduced myself as a new slate dealer, and soon found that I had made a good impression. In regard to making a change to use slate, Mr. Squire called his master builder (Capt. Dupree) to consult in regard to it. The captain told him that the building was not strong enough to hold slate. I inquired if he expected his building strong enough to hold shingles. "O yes," was the quick reply. "Then I can prove to your satisfaction that it is strong enough to hold slate. I assure you that shingles will absorb water and on a rainy day are heavier than slate, and if you will spare me a few minutes of your time to-morrow morning I will prove that fact." I went to my yard and cut a shingle 4x6 inches and put it in a tub of water. I went there next morning with the damp shingle and a piece of slate just the same size. They put them on the scale and found that I was right; the shingle was the heavier of the two. In that way I had the order for 180 squares of the Eureka No. 2, 24x12. They are now on the same building, just as good as the day they were put on, and since the above transaction I have used about 2,000 squares of roofing slate on Messrs. John P. Squire & Co.'s buildings.

Boston, Mass.

Yours respectfully,
W. J. GRIEFITHS.

September Slate Export.

Owing to the rising freight rates and increased movement of merchandise, slate exportation has fallen. The exports from New York in September amounted in value to \$78,701, against \$80,305 in August, and \$93,533 in July. In September, 1897, the exports were \$90,059, showing that this year they have fallen off \$11,358 in value. Nevertheless the year 1898 promises to show a material increase in the exports as compared with the last months.

Fortunately the Pen Argyl slaters are not involved in the strike now in progress at Bangor. All are busy at work every

day in the week, and we trust will be for some weeks to come, and all are earning good wages, considering the low price at which slate is being sold. The Pen Argyl slaters to-day stand above those of any slate section in Pennsylvania in point of wages and steady labor, and we hope this condition will continue indefinitely.—Index.

An inquiry among the slate operators reveals the fact that the home market for roofing slate is exceedingly flat, next to nothing; only an occasional order being received. The foreign market still consumes a fair proportion of the production, though the prices offered are in some instances very unsatisfactory.—Pen Argyl Index.

The sheriff has levied upon the Excelsior Slate Quarry, near Danielsville, Pa., to satisfy an execution for \$1,501.60 in favor of S. J. Packer and H. E. Davis.

The first slate at Northfield, Vt., has been taken out from the Dole-Brill slate quarry. The slate is very even in quality and handsome in appearance.

Poultney, Vt.—It is expected that the Griffith & Nathaniel quarries in South Poultney will start up again soon.

E. R. Norton and W. H. Hughes, Granville, N. Y., slate manufacturers, have gone to London. The sea-green slate manufacturers are to devote more attention to Europe as a market for the product, and it is with this object in view that Messrs. Norton and Hughes make this trip.

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SELECTED MISCELLANY.

"The Widder Clark."



I T'S gettin' on to winter now, the
nights are crisp and chill,
The wind comes down the
chimbley with a whistle sharp
and shrill,
The dead leaves rasp and rustle
in the corner by the shed,
And the branches scratch and
rattle on the skylight over-
head.
The cracklin' blaze is climbin'
up around the old back log,
As we set by the fireplace here,
myself and cat and dog,
And as fer me I'm thinkin', as the fire burns
clear and bright,
That it must be mighty lonesome fer the
Widder Clark to-night.

It's bad enough fer me, b'gosh, a-pokin' 'round
the place,
With jest these two dumb critters here and nary
human face
To make the house a home agin, same as it
used to be
While mother lived, fer she was 'bout the hull
wide world to me.
My bein' all the son she had, we loved each
other more,
That's why, I guess, I'm what they call a
"bach" at forty-four.
It's hard fer me to set alone, but women folks
—'t ain't right,
And it must be mighty lonesome fer the
Widder Clark to-night.

I see her t'other mornin', and, I swan, 'twan't
later'n six,
And there she wuz out in the cold a-choppin'
up the sticks
To kindle fire fer breakfast, and she smiled so
bright and gay,
By gee, I simply couldn't bear to see her work
that way—
Well, I went in and chopped, I guess, enough
to last a year,
And she said "thanks!" so pretty, gosh! it done
me good to hear.
She don't look over twenty-five, no, not a
single mite—
Ah hum! it must be lonesome fer the Widder
Clark to-night.

I sez to her, "Our breakfasts ain't much fun fer
me or you,
Seems if two lonesome meals might make one
social one fer two."
She blushed so red that I did, too, and I got
sorter 'fraid
That she was mad and, like a fool, come home—
I wish I'd stayed.
I'd like to know now if she thinks that Clark's
a pretty name,
'Cause if she don't and fancies mine, we'll
make 'em both the same.
I think I'll go and ask her, 'cause 't would ease
my mind a sight
To know 't wan't quite so lonesome fer the
Widder Clark to-night.

—Joe Lincoln, in L. A. W. Bulletin.

Shell Concrete for Pavements.

The shell concrete pavements of Macon, Ga.,
are attracting considerable attention at present,
and the following particulars concerning them
appear in an engineering exchange: The materi-
al used is a shell limestone similar to the
coquina of which buildings were constructed in
St. Augustine while it was a Spanish colony.
There is a bed of this stone about thirty miles
from Macon, which was discovered during the
construction of the Georgia Southern and
Florida railroad, some years ago. Part of the
roadbed of that railway was made of it, and it
hardened into such a durable form that several
carloads were brought to Macon and laid about
the freight station, where it resisted the wear
of the heavy traffic unusually well. After it
had been in service for four or five years, the
city paved a street having one of the heaviest
grades in Macon, with it, and this first street
gave such satisfaction that several more have
since been paved in the same manner. About
35,000 square yards are now in use, and peti-
tions for 10,000 yards more are on file. The
stone is crushed and laid on the sub-grade exca-
vated to receive it. The layer is about seven
inches deep at first and is consolidated by a
15-ton steam roller to a thickness of six inches,

being sprinkled at intervals. On heavy grades a gutter is formed by mixing cement with the stone. The pavement costs from fifty to sixty cents a square yard, which includes crushing and labor, and is reported to last well and remain unusually free from ruts. It has been found to require comparatively little sprinkling and to sweep well, although a softer broom than is generally employed for street sweeping must be used on it.

Speed Per Second.

The snail, one-half inch; a man walking four feet; a fist runner, twenty-three feet; a fly, twenty-four feet; a fast skater, thirty-eight feet; a carrier pigeon, eighty-seven feet; locomotive—sixty miles an hour—eighty-eight feet; swallows, 220 feet; the worst cyclone known, 380 feet; the Krakatoa wave—at the volcanic catastrophe of August 27, 1883, in the Sunda Islands—940 feet; the surface of the globe on sea level at the equator, 1,500 feet; the moon, 3,250 feet; the sun, five and a half miles; the earth, eighteen miles; Halley's comet in the perihelion, 235 miles; electric current on telegraph wires, 7,000 miles; induction current, 11,040 miles; electric current in copper wire armatures, 21,000 miles; light, 180,000 miles; discharge of a Leyden jar through copper wire $\frac{1}{8}$ -inch in diameter, 277,100 miles, which is said to have been the highest velocity measured.—The Wave.

Thawing Dynamite.

All nitro-glycerine compounds freeze and become hard at about 42 degrees Fahrenheit. In this condition they will not readily explode. When large quantities of powder are to be used, a separate building for thawing powder should be fitted with a small steam radiator. Use only exhaust steam for heating the same, if possible, keeping the temperature of the room at about 80 degrees Fahrenheit. In the part of the room at the greatest distance from the radiator, place the powder on racks to thaw. When but small quantities are required to be thawed, a thawing kettle may be used, being two water-tight kettles, one smaller than the other (one placed inside the other), the cart-ridges to be placed in the smaller kettle, and space between the two kettles filled with hot water of from 120 to 130 degrees Fahrenheit, the kettle being fitted with a cover to retain

the heat. Under no circumstances, however, should the kettle be placed over the fire to heat. When more hot water is required empty out the cold water and fill again with hot water. Under no circumstances should an attempt be made to thaw the powder by placing it in hot water or exposing it to the direct action of steam.—New York State Mining Law.

The Future of the Earth.

According to the ideas of astronomers, the earth was detached from the solar nebula, and, after being a "miniature sun," was condensed by cooling. Losing its heat by radiation in space, the fiery globe became covered with a solid, dark crust. The solid layer then acted as a barrier to the radiation of the molten mass beneath, for rock has a feeble conductive power. The sun, then, is the sole source of heat that has supported, and that yet supports, the terrestrial surface. On the formation of the solid crust, the water vapor diffused throughout the atmosphere condensed little by little, and water accumulated in the first depressions of the surface. Thus were formed the first oceans, in which life was soon to manifest itself in the most rudimentary organized forms. While these forms went on to develop into more perfect types, distributed uniformly over the globe, the cooling of the earth continued; foldings resulting from its contraction appeared on the surface, and its internal activity showed itself, at intervals, in various regions in the form of volcanic eruptions. The earth's profile thus became more accentuated by the elevation of mountains and the lowering of the first oceanic depressions. It is probable that vegetation then appeared on the first continents, whose temperature must have been tropical. But the outline of the surface did not depend solely on the contraction of the earth's crust, but also on erosion, due to atmospheric agencies. While the contraction, by lateral folding or vertical depression of layers, raised or lowered considerable portions of our planet, erosion produced an inverse effect, since by the action of rain, ice, and variation of temperature it disintegrated the rocks and reduced them to powder, which it transported and heaped up in the depressions of the crust. Consequently contraction accentuates, or at least preserves, in one form or another, the relief of the surface, which denudation is working to obliterate. The resultant of these

two opposite agencies gives us the form of the globe at any given moment.

In the course of geologic time contraction formed mountain chains. The first mountains, which were as high as those of to-day, have in great part disappeared by erosion; there remain only fragments, which the study of geology alone enables us to identify. As cooling continued, climates became differentiated, and to the lower plants and the invertebrate animals succeeded higher forms; fishes, reptiles, birds, mammals, and finally man. The human species had not yet appeared on the earth when the Pyrenees, the Alps, the Carpathians, and the Himalayas were formed. These are a part of the same mountain chain, whose relief is in great degree preserved, because it is the most recent chain and the action of time has altered it least. As long as contraction shall continue there will be mountain chains, a very accentuated relief, continental masses, and consequently an easy flowing of waters to the sea. But when by cooling the crust shall have become sufficiently thick and solid to prevent lateral folding, mountains will no longer be formed, and then, as denudation alone will act, it will level the surface little by little. Then, by the partial filling of the oceanic basins, by the greater and greater difficulty of flow (due to the lack of slope) of water toward the sea, the continental masses will be divided, by channels of greater or less size, into true archipelagoes. At this time there will be on the earth no more water surface than at present, but this water will be differently distributed. Nothing shows that at this period, far in the future, life will be impossible on the earth. Nevertheless, although the essential elements of air and water will not be lacking, cold will certainly bring about a change in the character of life, and a partial disappearance of living creatures from its surface.

M. Dollo, the learned Brussels professor, asks whether some other planet may not have already reached the stage we have just predicted for our globe? There is one, in fact, the planet Mars, of our own solar system. After the earth shall have reached the phase represented to-day by Mars, what will become of it? Instead of consisting of a crust and a fluid nucleus, it will be completely solid. It will then absorb into its crevices the whole of its air and its water. This will easily occur, for experience shows that for this it will be sufficient to be only one-third as porous and

only one-hundredth as full of fissures as the granites that are now traversed by millions of veins of harder rock. These fissures, which can no longer be filled with molten rock from the depths of the earth, will be occupied by water. If life has not already ceased by this time, it will then be no longer possible. And after this? Afterward, the fissures will increase as the mass contracts further, and the earth, cracked, dislocated, and finally broken in pieces, will rush through space as a shower of meteorites. The fissures observed on the moon's surface and the meteorites that fall on our globe enable us to believe in such a future state for the earth. Such, briefly summed up, are the series of phases through which our globe has passed and probably will pass.—Philip Glangeaud, in *La Nature*, Paris. Condensed for Public Opinion.

How Tacks are Made.

One of the first processes in the manufacture of tacks is that of pickling the Bessemer steel or best quality iron sheets. These sheets are about 16x36 inches or 20x36 inches in size, and quite thin. The pickling solution is of blue vitriol, which removes all foreign substances and renders the metal more pliable to work. A bath of hot lime thoroughly dries the sheets, which are next taken to the cutter, where carefully arranged steel knives cut them into any width desired, ranging from one-fourth inch to two inches. Each strip retains its original length. The strips now have jagged edges, but after going through a powerful machine the rough edges are removed, leaving a very smooth surface.

The strips are now ready for the tack machine, the knives of which cut the strips into the thickness required. Each little piece of metal as it leaves the knives is forced into a two-sided groove that closes tightly and gives to the tack the point and corrugations which lend to its holding qualities. At the same time a hammer strikes the broad end of the tack, putting a head on it, and then it drops into a receptacle beneath. The tack is now complete, save placing it in a revolving barrel, or tumbler, which gives it a bright finish. Blued tacks are colored by heat, and tinued tacks, after being dipped in the metal, having been previously pickled, are riddled and sieved together in a circular drum to prevent their sticking together.

OUR FOREIGN TRADE IN STONES, ETC.

From the monthly summary of finance and commerce of the United States, corrected to Oct. 26, 1898, we compile the following:

ARTICLES.	SEPTEMBER—				NINE MONTHS ENDING SEPTEMBER—			
	1897		1898		1897		1898	
	Quan.	Values.	Quan.	Values.	Quan.	Values.	Quan.	Values.
<i>Imports—</i>		<i>Dollars</i>		<i>Dollars</i>		<i>Dollars</i>		<i>Dollars.</i>
Cement (lbs.):								
Imp. from—								
United Kingdom.....	14,986,186	50,735	10,902,414	34,921	93,586,943	304,434	58,902,741	203,022
Belgium.....	12,603,059	36,113	35,284,479	109,33	145,844,813	424,483	205,777,794	612,895
France.....	7,894,405	21,859	297,400	1,167	13,575,278	39,722	2,064,800	10,094
Germany.....	45,860,687	161,174	35,636,373	124,433	264,935,523	1,161,693	300,293,619	1,016,472
Other Europe.....	1,388,900	4,484	1,892,014	6,305	13,398,900	48,553	17,004,722	53,946
British North America	389,824	1,888	185,400	879	1,345,399	6,385	1,367,950	6,560
Other countries.....					411	1	5,300	67
Total.....	83,191,011	276,253	84,096,680	281,458	60,688,267	1,985,293	589,016,766	1,902,356
Marble, and mfrs. of								
Stone, & manufactures								
of, including slate.....		29,332		18,694		197,906		169,369
Total.....		101,759		83,976		903,174		744,586
<i>Exports—</i>								
Marble and stone, and								
manufactures of:								
Unmanufactured.....		10,556		6,594		62,177		55,095
Manufactures of—								
Roofing slate.....		139,476		126,642		849,026		1,155,196
All other.....		26,900		27,495		347,695		312,424
Total.....		177,025		160,735		1,258,998		1,421,714
Cement..... bbls	4,367	7,192	4,125	7,752	40,809	72,167	21,550	52,106
<i>Exports foreign mfrs.</i>								
Cement, Rom., Portland								
etc..... lbs	290,189	866	1,349,148	4,422	1,192,785	4,856	4,495,900	16,634
Marble, & mfrs. of								
Stone, & mfrs. of includ-		19		16		3,488		1,603
ing slate.....		253		67		10,476		3,496
Total.....		271		83		13,964		5,09

Merchandise Remaining in Warehouse on Sept. 30, 1897, and 1898 Respectively.

ARTICLES.	September—			
	1897		1898.	
	Quantities.	Values.	Quantities.	Values.
Cement, Roman, Portland, etc..... lbs...	11 522,847	\$ 38,100	3,382,384	\$10,386
Marble and stone, and manufactures of:				
Marble, and manufactures of.....		14,216		36,072
Stone, and manufactures of, including slate.....		1,997		9,688
Total.....		16,213		46,356

Imports and Domestic Exports of Merchandise into and from the United States in its Trade with the Dominion of Canada during the year ending June 30, 1898.

ARTICLES.	Nova Scotia, New Brunswick & Prince Edward Island.		Quebec, Ontario, Manitoba and Northwest Territory.		British Columbia.		Total Dominion of Canada.	
	Qu'ntities.		Qu'ntities.		Quan t.		Quant.	
	Values.		Values.		Values.		Values.	
<i>Imports from—</i>								
Cement, Roman, Portland, etc..... lbs...	488,749	2,537	1,687,050	7,808			2,170,799	10,330
Marble and stone, and manufactures of:								
Marble and manufactures of.....				328		21		349
Stone and manufactures of, including slate.....		27,808		5,938		31		33,777
Total.....		27,808		6,266		52		34,126
<i>Exports to—</i>								
Cement..... bbls...	135	251	29,816	47,044	1,742	3,767	31,698	51,062
Marble and stone, and manufactures of:								
Unmanufactured.....		10,598		51,914		3,146		65,658
Manufactures of—								
Roofing slate.....				8,147		29		8,169
All other.....		4,087		76,592		5,344		84,933
Total.....		14,685		185,658		8,412		158,760

Imported Merchandise Enterea for Consumption in the United States, including entries for immediate Consumption and withdrawals from Warehouse for Consumption, with rates and amounts of Duty Collected during the year ending June 30, 1898.

ARTICLES.	Rates of Duty.	Quantities	Values.	Duties.	AVERAGE.	
					Val'e per unit of Quantity.	Ad valorem rate of duty.
Cement:			<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Per cent.</i>
Roman, Portland, and other hydraulic, in barrels, sacks, or other packages.....lbs.	8 cents per 100 lbs.....	789,575.406	2,549,991.85	631,660.13	.003	24.79
Other.....	10 per cent.....		11,110.00	1,111.00		10
	20 per cent.....		32,893.00	6,578.60		20
Lime.....lbs.	5 cents per 100 lbs.....	37,782.513	60,879.00	18,891.34	.002	31.03
Lithographic stones, not engraved	Free		51,730.00			
Marble, onyx, and stone, and manufactures of:						
Marble—						
In block, rough or squared only.....	50 cts. per cubic foot.....	21,057	37,893.00	10,528.50	1.70	27.78
.....cub. ft.	65 cts. per cubic foot.....	293,787	401,631.46	190,944.71	1.37	47.54
Sawed or dressed, over 2 inches in thickness.....cub. ft.	85 cts. per cubic foot.....	8,779	13,745.00	7,453.79	1.56	54.40
Slabs or paving tiles containing not less than 4 superficial inches:.....	\$1.10 per cubic foot.....	407	1,174.00	447.70	2.88	38.13
Not more than 1 inch in thickness—						
Unrubbed.....sup. ft.	12 cts. per sup. foot.....	147,527	17,738.00	17,701.44	.120	99.80
Rubbed.....sup. ft.	15 cts. per sup. foot.....	10,930	1,643.00	1,639.50	.150	99.79
More than 1 inch and not more than 1½ inches thick—						
Unrubbed.....sup. ft.	15 cts. per sup. foot.....	147,512	20,311.00	21,979.05	.138	108.21
Rubbed.....sup. ft.	18 cts. per sup. foot.....	320	25.00	57.60	.078	230.40
More than 1½ inches thick and not more than 2 inches thick—						
Unrubbed.....sup. ft.	18 cts. per sup. foot.....	4,474	945.00	805.32	.211	85.22
All other manufactures.....	45 per cent.....		5,017.00	2,257.65		45
	50 per cent.....		110,087.53	55,343.76		50
Onyx:						
In block rough or squared.....cub. ft.	\$1.50 per cubic foot.....	1,912	6,078.00	2,868.00	3.49	43
Slabs or paving tiles containing not less than 4 superficial inches—						
Not more than 1 inch in thickness—						
Unrubbed.....sup. ft.	12 cts. per cubic foot.....	2,967	1,985.14	356.04	.669	17.94
Rubbed.....sup. ft.	15 cts. per cubic foot.....	24	16.00	3.60	.666	29.50
More than 1 inch and not more than 1½ inches thick—						
Unrubbed.....sup. ft.	15 cts. per cubic foot.....	521	5 2.83	78.15	1.	14.94
All other manufactures.....	45 per cent.....		637.00	286.65		45
	50 per cent.....		6,066.36	3,033.18		50
Total marble and onyx.....			626 715.32	315,784.64		50.39
Mosaic cubes of marble, onyx, or stone, not exceeding 2 inches in size—						
Loose.....less.	1 ct. per lb. & 20 pr ct.	1,846,053	24,682.00	22,996.93	.012	101.39
Attached to paper or other material.....sup. ft.	20 cts. pr lb & 35 pr. ct.	3	7	2.95	2.33	42.14
Stone:						
Slates, roofing.....	20 per cent.....		58.00	11.60		20
Slates, slate chimney pieces, mantels, slabs for tables, and all other manufactures of slate.....	20 per cent.....		4,866.10	973.20		20
Freestone, granite, sandstone, limestone, and other building or monumental stone, except marble and onyx, not specially provided for—						
Hewn dressed or polished.....	30 per cent.....		11,903	4,470.60		30
Unmanufactured or undressed.....cub. ft.	50 per cent.....		159,245	75,129.50		50
	7 cts. per cubic foot.....	4,146	893.40	290.22	.215	32.50
Burrstones, manufactured or bound up into millstones.....	12 cts. per cubic foot.....	48,606	13,135.00	5,839.77	.272	44.18
Grimestones, finished or unfinished.....tons.	15 per cents.....		1,338.00	200.70		15
All other manufactures of stone not otherwise provided for.....	10 per cent.....	139	2,661.00	266.10	19.14	10
	\$1.75 per ton.....	4,183	50,917.03	7,319.27	12.17	14.35
Total stone.....	20 per cent.....		151.00	30.20		20
Total marble, onyx and stone.....			239,226.13	94,517.16		39.54
Pumice and Pumice stone.....			865,941.35	410,301.80		47.38
Pumice Stone:						
Unmanufactured.....lbs.	Free.....		3,078.00			
Wholly or partially manufactured.....tons.	15 per cent.....		16,891.00	2,533.15		15
	\$5.00 per ton.....	608	14,283.00	1,184.48	20.46	23.36



TIMELY TOPICS

A Note of Warning. A prominent New England granite company recently paid \$2,500 to a pneumatic tool company "rather than lose valuable time in dancing attendance on irritating litigation," threatened by the owners of a patent on what is alleged to be the basic invention of that class of tools. The stone trade will have to undergo some experience in the use of patented machinery before they will realize the proper way of buying it. That has been common experience in many industries in which machine invention has been progressive. Solomon, the typical wise man of the world, was probably correct in his averment that "there is nothing new under the sun," but he was not familiar with the procedure of examining into the facts of the matter as practiced by the United States Patent Office. The so-called inventor who gets onto the ground floor of that institution can come forth panoplied to scare the daylights out of anybody who makes use of a mechanical contrivance resembling in its aspects a "foundation" patent. That's the dilemma of the New England granite company referred to. It paid tribute, because it would have cost more than the settlement demanded to litigate with the patentee. So it bought exemption. It was cowardly, but it did it.

Those in the stone business have not yet learned, through sorry experience,

what many other manufacturing lines have learned, that the individual cannot hope to escape disaster by undertaking to fight injustice of this sort single-handed.

We sound the note of warning, that trade organization alone can cope successfully with the patent sharks that menace it now, and the breed of which will multiply quickly and continuously as the mulcting process moves along successfully. Each demand for tribute, yielded to under threat of litigation, becomes a precedent for exacting tribute from the next one called on. Granite manufacturers, as well as stone and marble manufacturers, may just as well prepare themselves for the call that will be made on them, if they are using any other pneumatic tool than the one known as the "McCoy." The way has already been prepared by the owners of the patents on that tool, by their litigation, past and pending, with manufacturers of other tools. They have some very strong decisions, which arms them well to proceed with energy against users of tools alleged to infringe their own. We counsel courage on the part of those who are attacked. Yielding for the sake of immunity, in a matter of this sort, is much like compounding a felony. McCoy's claim is not impregnable. We have reason to believe that the constructive idea involved in his tool has not been traced

to its beginning, nor has the priority of the process been discovered as belonging to him, by any inquiry or decision, that will justify the levying of tribute on the users of other pneumatically operated boring or cutting tools. But the fact must not be overlooked that the users of such tools are put at once on the defensive. It becomes their business to overthrow the attack, or passively submit and pay tribute. As stated, the patentee can't be beaten single-handed. If this menacing litigant is to be downed, it will require the concentrated effort of every pneumatic tool user in the country who is not immune. It will be beyond precedent of all similar affairs if he is not overthrown by such united effort. A national organization of the stone, marble and granite industries is necessary, and every manufacturer must pay his portion relative to the interests involved to support it, or submit to be crunched by the patent sharks that will swarm around him.

Will they heed the warning?

Stone Business and the Town Meeting. We don't believe that the best way to boom the stone business is by the town meeting method.

It would be a good deal more effective to do it with printer's ink.

A discussion of ways and means to help the business of a community, when participated in by numbers whose individual interests are of varying proportions, we have never known to result in anything except the "waste of good wind."

And we mean result in a permanent sense.

Resolutions don't stick!

Printer's ink does!

What a community may resolve to do, and thereafter attempt to do faithfully and honestly, may be disorganized by a

single disgruntled member who has means and desire to make opposition.

But the effects of judicious, truthful advertising cannot be overturned by any means.

We are led to these observations by reports of efforts that have been undertaken in certain cities to focalize attention to their resources of valuable stone for building or decoration, by holding town meetings and inviting an "expression of views," and pledges withal, from Tom, Dick and Harry, how to do it and their help to do it. This is all well enough, it seems to us, because we would value the proceeding as a strong factor in aid of the essential work which we have already suggested. But, in all the cases of the kind that we have noted, "the mill does not grind with the water that has passed." The enthusiasm displayed at the town meeting always waxes slothful when the real work appears. To achieve results requires money and plodding effort. The enthusiastic boomer who can't, or won't, give both, "makes a sneak" about the time he is most wanted, unless, perforce, he is selfishly interested.

No industry can be built up in a day. This is emphatically true in respect to the stone business. Stone is a product requiring years of use and exploitation to develop a character for it. What is the true explanation for the preference in the West for the granites of the far East, or the preference in the East for the limestones and sandstones of the West? Simply that the favored products have gained character by long use and continuous advertising. No indorsement of a town meeting has done it, or helped much to bring about the result. But, let us not be understood as discrediting general effort as a means to the end. STONE looks upon the town-meeting idea as simply the beginning of a hoped-for ending. It

believes "Keeping everlastingly at it," is the only effective procedure with relation to the upbuilding of a competitive industry through advertising. So, when any community hires a band to make music, expecting thereby to draw trade to the town, it were well to enlist the musicians for life. If the money to do this can most easily be raised by everybody interested chipping in according to his size, very well. But we counsel the abandonment of the spasmodic effort, such as the town meeting usually is, unless provision be made to "sound the praises" of the stone while a carload of it remains to be sold

The Trophies of War. Our late war for humanity (?) produced what might aptly be termed the "elastic idea" in governmental policy. We have been shown how to stretch ourselves. Of course, before the war we had a pugnacious regard for that Monroe doctrine. We would have gone to war over it. But when it comes to keeping what we have taken from the bloody foreigner in humanity's cause, Monroe or any other old doctrine doesn't go. Likewise in respect to the doctrine of a high protective tariff. It will require a good deal of stretching to make that fit with the idea of expansive commercial trade with other nations. So, it looks as if we will have to bring forth other bugaboos than those conjured out of our relations with foreign powers who hanker after American privileges. A nation that can in a few months' time begin, prosecute and end a war for humanity, and not relieve a single suffering human being; that destroyed fleets and captured armies while all the world stood stiffened in wonderment, must have an elastic policy to fit the rapid changes that take place when Uncle Sam "gets a move on

himself." They will get around to the reconcentrados of Cuba after the matter of fixing the commercial status of the island is suitably arranged for those who are "on the inside" of the partition. In the meantime, let the Lion roar and the Black Eagle scream; let the polar Bear give forth his guttural and the ambitious yearlings among the nations snort and snarl, this great Yankee nation doesn't give a darn!

The Right to Work. Theodore Hoffman is a non-union marble cutter in New York. One day a few weeks ago he shot Patrick Rocke, a union striker, fatally. Rocke was mad because Hoffman insisted on working and attacked the latter, the result being that Hoffman shot him in self-defense. That Hoffman is not a union worker seems not to be his own fault. Ten years ago he was fined \$25 for working two days under a non-union foreman and was put out of the union because he could not pay the fine. Four years ago he was told that for \$165, his fine and arrears in dues, he could become a member in good standing of the union. He could not get the money and accordingly by this arbitrary ruling of the union he was kept out of the organization. He has a wife and ten children to support, and was, of course, obliged to obtain employment as a non-union man. Hoffman is in jail; his victim is in the grave; the wife and ten children are in the misery of poverty and despair, and there is unutterable grief in the late home of the dead. What a tragedy that is! And as a sequence of what?

"I had to work for a non-union boss," said Hoffman. "I have a large family and could get no other work. It was that or let them starve. I would have been a union man if I could, but I have ten

children. I could not save money enough to pay the fine and dues." Who dares say, in the name of all that is worthy in human character, that this man was not right in what he did for himself? Not what he did to another—for he had no right to take human life, except in defense of his own or of those in his care—but in his right to work for whom he pleased. And for his privilege to do so unmolested, the laws of this nation vouchsafe him license and protection. And in those respects his declaration flashes like a flaming sword this command to the menacing mob: Stand aside! Let an honest man pass!

If Hoffman spoke and acted as it is reported, he is an honest man—honest in that he considered it his first duty to provide for those whom God had placed in his care and protection. Those were in the wrong who dogged him toward his home that fateful day, and drew from his forbearance and courage the impulse to kill. Such a method of maintaining the principles of trades unionism makes more "scabs" than a hundred unjust but peaceable strikes.

"Home Labor." How much of what is termed "home labor" do you suppose a contractor could depend on in cases where it is required to

be employed in preference to any other kind? Never enough, if the letter of the ordinance were observed. Probably 75 per cent. of the stone-cutters in this country do not reside in one place more than one season. The stipulation in contracts to employ home stone-cutters does not mean anything much more than that stone-cutters traveling on the card of another union and coming within jurisdiction of the local "branch" which has preference on the job, becomes, at once they are cleared into such branch, "home labor." The non-union cutter at home has no standing, preferentially, as "home," or any other sort, of labor, and why not? On public work, for instance, the letter of the ordinance requires home labor to be given preference, but the non-union local stone-cutter is deliberately shoved aside to give place to the migratory stone-cutter with union credentials. That's a common experience, but it shows clearly as anything can be shown that political bodies do not consider the employment of home labor in the light of a fair principle, but rather as an obsequious service to party. Truly, it is time that this stipulation should be left out of contracts for public works, if it does not mean that home labor, without distinction as to creed, class or color, is plainly understood.



ONLY A TEMPORARY RECEIVER.

In the issue of *STONE* for October under heading of "Notes from Quarry & Shop," you publish that this company was put into hands of a receiver, which was the case for about forty-eight hours, the judge having appointed the receiver without first giving us notice that this was to be done, but as soon as we could prepare a statement to show the court, the receiver was discharged, and the claim was paid in full, and we are doing business as usual. The matter was a little piece of malicious persecution, and never ought to have occurred. Inasmuch as you have given the matter considerable prominence by publishing it in *STONE*, we wish you would in the next issue publish the fact that the receiver has been discharged, etc.

Yours truly,

THE MAXWELL BLUE STONE CO.
Per E. DAVIS, Sec'y.

Cleveland, O., October 31.

BEDFORD, IND.

A large party of stone contractors and dealers from New York City, Boston, Springfield, Mass.; Newark, N. J., and other Eastern towns, were in Bedford recently as the guests of John R. Walsh, to look over the Bedford stone district. Those who registered were: From New York: John Morrison, J. J. Spurr, B. J. Linehan, M. C. Henry, H. J. Hoehner, D. Miller, B. A. Williams, J. A. Jackson, C. P. Smith, E. Ball, James Shaw, G. C. Brown, E. Shuttleworth; Brooklyn: William Bradley; Boston: F. V. Coughlin, E. Gibeson, J. B. Henry; Worcester, Mass.: George D. Webb; Springfield, Mass.: J. P. Falt.

The Indiana Supreme Court has affirmed a judgment for \$5,000, recovered by Granville Wray against the Peerless Stone Company for injuries inflicted by the falling of some stone in its quarry at Bedford in 1892. This was the fourth judgment recovered by Wray in this case, the others having been reversed on appeals by the stone company. The first judgment recovered was only about half the size the one affirmed. The last trial was held in Bloomington. Following is the decision taken from the Mail:

18,418. Peerless Stone Company vs. Granville Wray. Monroe C. C. Affirmed. Howard, Judge.

(1) Unless an amended complaint introduces a new cause of action, it has reference to the time the original complaint was filed, and the fact that the period of limitation had run after the cause of action accrued and before the

amended complaint was filed, would not bar the action if it was not barred when it was first begun. (2) Unless the answers to special interrogatories cannot be reconciled to the general verdict, and are not so contradictory as to destroy each other, the general verdict will stand. (3) A workman in a stone quarry is bound to guard against obvious dangers, open to ordinary observation, but not against latent defects to be discovered only on particular inspection. (4) After the jury and the trial court, who saw and heard the witnesses, have decided in favor of the appellee, the Supreme Court will not weigh the evidence to determine its preponderance.

SAULT STE. MARIE, MICH.

There was no news last month. There is to be let here this month a convent. Brick with stone trimming; to cost \$10,000. Also a small weather office for the government; brick, with stone trimmings; cost, \$3,000.

The Water Power Company are beginning to get to work in good shape, but there is no stone work yet. I think, however, there will be lots of stone work here next spring.

MILWAUKEE, WIS.

Most everybody busy at present.

Chas. Riske is to build a brick veneered flat, to cost in the neighborhood of \$20,000.

A new lock is to be built at Menasha when navigation on the Fox river closes, probably some time in November. The lock will be of stone and much larger than the wooden one now in use. A force of one hundred men will be employed in building it.

The Pabst Brewing Company is to build a cooper shop, at a cost of about \$70,000. It is to be 164x141 feet, three stories high, and of solid brick.

Plans for the new German parochial school have been completed and the contracts will soon be let for a \$35,000 building. The foundation will be built this fall and the whole structure will be ready before the beginning of the next school year.

MANSFIELD, O.

Owing to the great dullness in the building trade in this city and vicinity, I did not have any news last month to send to *STONE*. There are thirty-two stone-cutters working on the new wing of the Ohio State Reformatory, but the prospect of an early shut-down is very probable, as the stone is not coming in as fast as it was expected, and cold weather will soon be here.

S. W. Bowers is to build a three-story store building. Brick and stone trimmings. Architect not decided on as yet.

Messrs. Weary & Dole, of Akron, are the architects who have charge of the work on the Ohio State Reformatory, Alfred A. Dole acting as superintendent of construction.

The Mansfield Land and Improvement Company are shipping variegated stone from their quarry here, which is being used in the construction of the residence for the superintendent of the State asylum at Massillon.

The building of the Lucas county jail at Toledo will start soon, giving employment to quite a number of stone-cutters.

O'CONNOR.

EVANSVILLE, IND.

I have waited to see the outcome of the letting of the new water works building here. It has been let to George F. Weikel, a brick contractor here, for \$57,000. Concrete foundations; brick, with Bedford stone trimmings. The stone work is sublet to the Climax Stone Company, of Bedford, Ind., and will be cut at the quarries. This is a great disappointment to stone-cutters here and not very satisfactory to people in general. The stone-cutters' Society here "scabbed" the job and are not willing to trim after the machines.

Brick and asphalt street work is nearly completed and the building trade is dull in stone lines. Nothing prospective.

SCHOENBAUM.

BALTIMORE, MD.

Business in the stone line does not seem to take a spurt and reckon it will not until spring at least.

A row of twenty-odd houses is in the market, but has stone only up to parlor sills, so I am informed. There are several other jobs in sight, but not of much consequence.

I do not know that you are aware of the fact, but the Beaver Dam Marble Company, of this city, is in full possession and ownership of the extensive plants and quarries and adjacent ground at Cockeysville, Md., they having paid, according to press notices in the "Record" column, \$45,000 for the same to the Bosleys, *et al.* I have no doubt that in the future these quarries will be heard from more than they have in the past, although a great deal of this marble has been used in the East.

WILKERSON.

MR. GORSE REPLIES TO MR. PATCH.

It is very evident that Mr. Patch, in his eager anxiety to reply to my article in September *STONE*, has entirely ignored the point at issue. One would infer from his side of the argument that I had written a treatise condemning the use of steam drills in boring tunnels and quarrying rough rock. My plea was confined to the stone yard and the building, not traversing the bowels of the earth or roaming through a quarry. His reference to the use of machinery in the preparation of the stone for the building of King Solomon's Temple is a little too ethereal even for an illustration in the stone industry. He does not say if it was a hand-

saw the workman used, or if it was of mechanical construction driven by some motive power of which even he is utterly ignorant; he insinuates, but fails to demonstrate the fact. Had he read my article closely he would have seen for himself that I do not condemn the use of machinery altogether, but that I endeavored to place it in its proper sphere, to be used in a proper and conscientious manner. In this way it would not prove a very formidable competitor to the artisan, and its mechanical production would be more endurable.

Stone is so brittle and full of seams or veins that the enormous pressure of the machine and the immense vibration caused by the forward motion, and resistance of the stone, causes a slight disintegration of these seams. It is not noticed at the time, but the settlement of the building brings forth these defects in abundance. Uneven settlement, we all know, will cause a breakage, but the number of broken stones in a machine-cut building compared with a building of the same magnitude cut by hand, prove that there is something not entirely right. These comparisons can be made in the city here.

Again, if the stone-cutter in roughing out a piece of moulding goes down too close with his point the evidence is seen by a white mark. This is the distinguishing mark of a stun. Can Mr. Patch tell me, or explain, why the stone from a planing machine is so much whiter than a hand-cut stone? If it is not one whole stunned surface, what is it?

In reference to the cutting of that drip to which Mr. Patch alludes, I beg to inform him that any stone which will not hold together under the hands of a competent workman is not a fit stone for building purposes. All the delicate and beautiful examples of architecture in Europe silently prove that Mr. Patch's wainscoting and panels are not the only wonders of the age.

I do not condemn the machine because it deprives a workman of an honest day's labor, I condemn its abuse. Labor-saving machinery is all right so long as it does not deteriorate the thing it produces; otherwise its object is a greed for gain.

Owing to the unequal nature of stone—some parts hard and some soft—the stone-cutter has to hold his tool at various angles so as to avoid stunning the soft parts. That sense of touch which the human hand possesses guides and teaches the practical workman where these soft spots occur, and he treats it according to its nature. Now the planer, being a rigid machine, treats every part of the stone with equal force. There is no flexibility, or give and take, consequently some parts of the stone must be incinerated.

Stone being a mass of matter varying in its compactness from A to Z, its variety in withstanding pressure when equally distributed will run the gamut somewhat similar. It must be treated according to its measure. The workman is taught to pay attention to these natural laws, but the planing machine disre-

gards them. An equal rigid force from start to finish is the law of the machine.

The extreme whiteness of the surface of a planed stone varying from $\frac{1}{8}$ -inch to $\frac{1}{4}$ -inch in depth testifies to a certain amount of pulverization or incineration, the result of rigid pressure, producing great vibration, which disintegrates the small particles of matter of which the stone is composed, whereby the acidity of a city atmosphere is better enabled to complete that decomposition which so many learned men of the past century have tried to remedy. A very good example can be seen in London, England, taking St. Margaret's Church and St. Stephen's Club for comparison. They are not very far apart, and both are built of Portland stone. The former (St. Margaret's Church) was designed and erected under the supervision of Sir Christopher Wren, the great English architect. The stone was all cut by hand and is still in good preservation, for the marks of the stone-cutter's tool is still visible on many of the mouldings, while the latter (St. Stephen's Club) was erected by the Battersea Steam Moulding Works not very many years ago. As the name implies, they used machinery on the stone, with the result that there is not a mould in the building intact. It is evidently the result of something. What is it?

The same remarks can be applied to Stronghurst College, Lancashire, England, where the machine was used on an addition unknown to the authorities who a few years later began to notice that the mouldings of the addition were decaying. They could not understand it, for the stone in the old building was of the same class of rock and was still in good preservation. Upon investigation they learned of the use of the machines, and traced the decay to their use.

There is any amount of evidence in New York City, but "where ignorance is bliss 'tis folly to be wise." If the speculator wants a stone front for the same cost as a brick front, let him have it, and the consequences, for "all is fair in love or war," which, after all, is only speculation.

As long as the hand can produce a better article than the machine it will always have a certain amount of demand, but when the ma-

chine can produce it a little better for a cent less, then good-bye to hand labor, and not before.

HENRY GORSE.

October 28, 1898.

CLEVELAND, O.

Trade is at the same old standstill here, as when I reported last month; barely enough to go around. Men are idle at all times, going and coming. It has been an exceedingly dull season, and it is to be sincerely hoped that with the going out of the year '98 that all of Cleveland's bad luck will go with it. We have been waiting patiently for the municipal buildings, the county court house, the public library, and also the two High school buildings, and then again the cathedral which has been promised for the past ten years. There is plenty of work promised, but who is it that keeps it from coming out?

Last week representatives of the three large stone companies of Cleveland and a committee of stone-cutters waited upon the building committee of the school council to urge upon them to use stone in preference to terra cotta in the two new High school buildings. The arguments brought forward by the stone men told very plainly upon the committee that they had not given it the proper attention that they should. We made a very good impression upon them.

GEORGE.

PEORIA, ILL.

Times are quiet in Peoria at present; that is, in regard to building improvements. Otherwise Peoria is all awake.

There is a new telephone company going to do business here and they are now making underground connections. The company will erect a three-story building. Brick with stone trimmings. Contract let last week.

The Weir Plow Works, recently destroyed by fire at Monmouth, Ill., are to be rebuilt and operated in this city by Kingman & Co., who reside here.

SCALLY.



MACHINERY AND SUPPLIES.

[Matter appearing under this head is compiled and edited from data furnished by the advertiser, and should not be accepted as the opinion of the publishers.]

A "TELLING" TESTIMONIAL,

To the Pittsburg Crushed Steel Co., Pittsburg, Pa.:

PROCTOR, Vt., August 18, 1898.

"We agree to use your Diamond Crushed Steel exclusively in all our gangs that are suitable for its use, and also on any other gang which we adapt for this material.

Ship us at once (3) three tons, one-third to Center Rutland, one-third to Proctor, and one-third to West Rutland, Vt."

(Signed) VERMONT MARBLE CO.

Secure in its merits over any later material adopted to supercede sand in sawing and rubbing stone, is the original product known as chilled-iron globules, or shot, solely supplied by B. C. and R. A. Tilghman, of Philadelphia. For speedy effect, economy in cost, and saving in saw blades and power, it is said no abrasive material can equal it. Get their circulars and price lists.

The Bedford Quarries Company, of Bedford, Ind., are at present busy supplying the incomparable Indiana oolitic limestone for several large jobs. The stone for the magnificent new court house at Fort Wayne, Ind., was furnished by this company.

Historians report the existence in ancient times of several score distinguished individuals surnamed Hercules. They were powerful fellows. The modern "Hercules" is but a name given to things that signify strength and power. That's why A. Leschen & Sons Rope Company, of St. Louis, adopted the name as a brand for the excellent wire rope it manufactures. They call it the "best on earth." It would be well to inquire of them the reason for that, when you are in need of wire rope. They can, no doubt, give you a satisfactory answer.

You can no more operate a quarry or stone mill without tackle blocks, than your cook can prepare a first-rate dinner without pans or kettles. But some tackle blocks, like some cooks, are better than others. To be sure of the best use the "Sure Grip" blocks of the Fulton Iron and Engine Works, of Detroit, Mich.

If a census were taken of the sand feeds in use in the saw gangs operated nowadays, the Hawley feed would no doubt lead in number all the rest. It is a simple, effective arrangement, and feeds crushed steel and chilled shot as well as sand. Ask E. J. and C. H. Hawley, Manchester, Vt., about it before you buy.

Stone-cutters, in refitting your kits, don't overlook the special tools made by Hammacher, Schlemmer & Co., 209 Bowery, New York.

They make very excellent implements. Ask them for their catalogue, and when in need of special tools get their prices and guarantee.

There's scarcely anything in the line of stone-producing and stone-working machinery that Thomas Carlin's Sons, of Allegheny, Pa., do not supply out of their own patterns and shops. The concern is somewhat of an emporium in which may be found any machine or appliance essential to the equipment of quarry and mill. Get their latest catalogue.

TRADE LITERATURE RECEIVED.

From the Contractors' Plant Company, Boston, Mass.: An illustrated folder in which is described the construction and operation of the portable gravity concrete mixers produced by this company.

From Earle C. Bacon, Havemeyer Building, New York City: A magnificently illustrated and printed large-size regulation pamphlet, and complete catalogue and price list of ore and rock crushers, screening and conveying machinery, and mine and quarry supplies. A very valuable addition to the catalogue library of those engaged in the mining or quarrying industries.

From Builders' Iron Foundry, Providence, R. I.: A pocket pamphlet containing illustrations, measurements and prices of grinding and polishing machinery and supplies.

From the Mechanical Rubber Company, 230 Randolph street, Chicago: A neatly arranged and nicely illustrated catalogue and price list of rubber goods for mechanical purposes. Very interesting, descriptively treating of the use of rubber in the mechanic arts and industries.

From Whiting Foundry Equipment Company, Harvey (Chicago), Ill.: A revised and expanded edition of its general catalogue, standard size. While the business of this company is, principally, the equipment of foundries, it also manufactures numerous appliances for several other industries. For the stone trade especially its products in cranes, air hoists and derricks are varied and extensive. The catalogue will be mailed to anybody on request.

From Lidgerwood Manufacturing Company, 96 Liberty street, New York: A bulky, up-to-date catalogue of about everything in the lines of hoisting and conveying machinery. The quarryman's, or stone contractor's collection of trade literature is incomplete without this magnificent catalogue of one of the oldest and best known manufacturing concerns in the country. It would be as difficult to find out what it doesn't make as it would be to find where the name Lidgerwood is unknown. Its reputation is co-extensive with the mining and quarrying interests of the world, and there is nothing in hoisting and conveying apparatus that it cannot supply, in any quantity, on demand.

Cost of Broken Stone Roads.

The cost of broken stone for building roads is not so great as many suppose. It can be bought at the crushers for 40 cents per solid yard, and the railroads will freight it forty miles, or less, at about 50 cents per cubic yard, making a total of 90 cents; but suppose we call it \$1. Then if the roadbed is nine feet wide and the stone is piled on a foot deep, a cubic yard will cover three feet linear, at a cost of \$1, making one mile, 1,760 yards, cost as many dollars. But as only about nine inches are necessary, one-fourth of this amount, or \$440, should be deducted, making the exact amount only \$1,320, which is cheap enough for a first-class road, the material for which must be brought forty miles by rail.—Indiana Farmer.

It has been said that the West has so little stone suitable for road-building and such limited quantities of gravel that the leading roads would have to be laid with steel tracks, but it has been found that Minnesota, at least, is differently situated and that near Taylor's Falls there is enough good trap rock to surface all the leading roads of the state.

SITUATIONS WANTED.

Advertisements under this heading inserted for subscribers to STONE free of charge. Advertiser must send 25 cents to pay postage, if replies are to be addressed in care of STONE. Rate to non-subscribers, 10 cents per line each insertion.

WANTED—Position; 16 years' experience as foreman and superintendent in general contract work, quarries and heavy masonry; expert on broken ashlar work. First-class references furnished. Address J. B. GORDON, Roscoe, New York.

A STONECUTTER, 21 years old, desires a position as office assistant, draughtsman, or assistant foreman in a stoneyard. Understand plans; can lay out work, etc.; have had an education; salary no object; want experience. Address, B. E. HANSEN, 599 Pine Grove Ave., Chicago, Ill.

A MAN who is thoroughly acquainted with the Granite Business in all its details, having an experience of 15 years, wishes to correspond with reliable wholesale manufacturer or quarryman regarding a situation, either for road or office position, after January 1, 1899. Correspondence confidential. Address G. B., care of STONE.

TO SELL. TO BUY. TO EXCHANGE.

Advertisements inserted in this department for 15 cents per line each insertion.

FOR SALE—Blue Stone Quarry, located Summit, N. Y., 37 acres; also steam drill in good condition, separate or together; price low. For particulars address T. H. MAGILL, Troy, N. Y.

FOR SALE CHEAP—One Ingersoll 3½ F. Drill, mounted on quarry bar for channelling. Little used and in good running order with some steels: \$200. Also, one 50-H. P. Tubular Boiler, with Blake steam feed pump; in good condition, \$200. Address NAPERVILLE STONE CO.

FOR SALE—Nos. 2 and 3 Gates Gyratory Crushers, One 12-ton steam roller, cheap. A. N. FITZSIMMONS, 1625 Monadnock Block, Chicago, Ill.

HELP WANTED.

Advertisements under this heading 10 cents per line each insertion.

HELP WANTED—Sawyer for marble and stone. Address ALBERT WEIBLEN, New Orleans, La.

D. W. Pratt

MACHINERY, Engines, Boilers, Rock Drills, Stone Saws, Air Compressors, Steam Pumps, Pulsometers, Hoisting Engines, Cableways, etc. Send for Special Catalogue. 211 Lucas Ave., St. Louis, Mo.

Locations for Industries at Chicago.

Industries located } Best Switching Facilities.
on The Belt Ry. } Direct Connection with all
of Chicago, have } Chicago Roads.
Competitive Rates.
Abundant Car Supply.

Parties contemplating the establishment of Industries near Chicago are invited to correspond with

B. THOMAS,
Pres. & Gen. Mgr., Dearborn Station, Chicago.

PUBLIC AUCTION.

Nov. 21, '98.

ADMINISTRATRIX SALE

Choice Limestone Quarry,

Consisting of 35 acres more or less. Title perfect. No incumbrance. Located at

NEWPORT (MONROE CO.), MICHIGAN.

Of this Newport Stone Quarry

The Michigan Central Railroad crosses its east end. The Lake Shore and Michigan Southern Railway its west part. With "Old Port" at the mouth of Swan Creek, only three-quarters of a mile away, on Lake Erie. These ways will furnish the finest transportation to all points on the line of these great railways, and towns on Detroit river and Lake Erie.

The City of Detroit, Mich., only 27 miles away; and of Toledo, Ohio, 31 miles distant; with the state of Michigan, at large, is presented one of the finest markets on this continent. The statute laws of the State of Michigan provides for a county system of good macadamized and other class of wagon roads, which each year henceforth will increase the demand for stone in the interior, to say nothing of the immense demand by cities and towns.

We invite the attention of Stone Men and Capitalists. Sale commencing at 10 o'clock in the forenoon on the premises at Newport, Mich.

MRS. S. M. GARTWRIGHT,
ministratrix, Wyandotte, Mich.

"KRUSHITE."

The Best and Cheapest Abrasive for
Sawing Stone.

CIRCULAR AND SAMPLE FREE FROM

FRENIER & LeBLANC, RUTLAND,
Vermont.

"We take pleasure in banking STONE every month. There are no flaws or shakes in it, and it always fills the mould."—*George Leuchers, Great Falls, Mont.*

**THE KENNESAW
MARBLE COMPANY,**

MARIETTA, GA

GEORGIA

MARBLE

ITALIAN

For

Monumental and Interior Purposes.

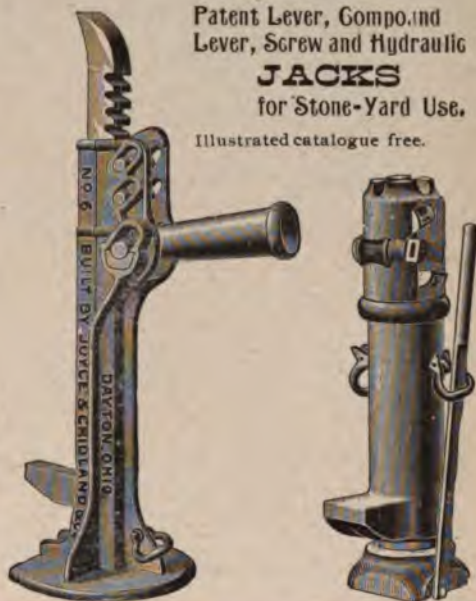
The Joyce-Cridland Co.

Dayton, O.

Manufacturers of

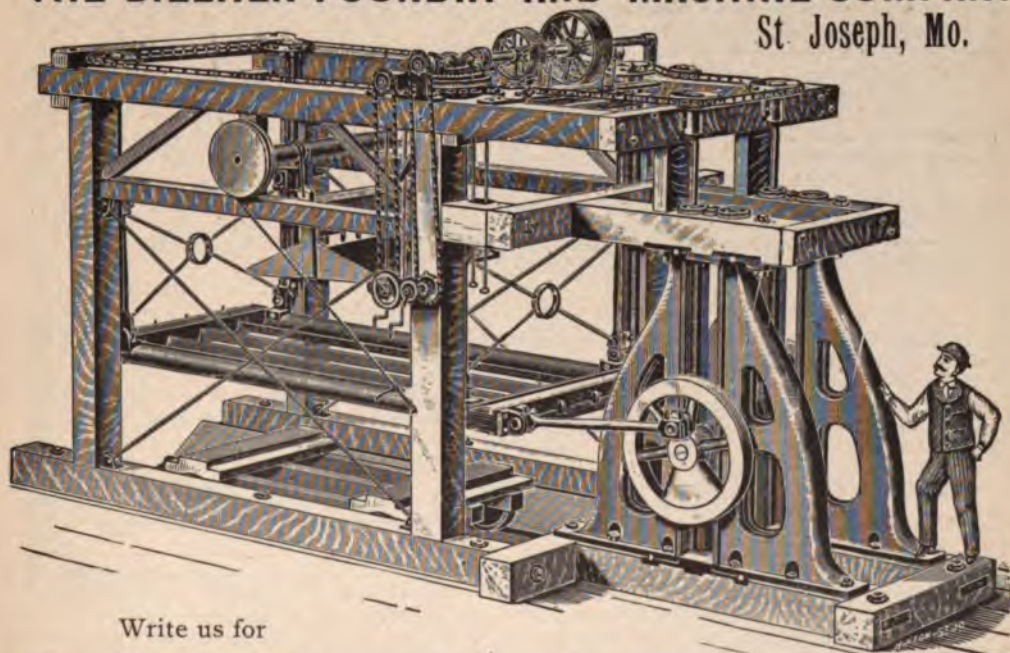
Patent Lever, Compound
Lever, Screw and Hydraulic
JACKS
for Stone-Yard Use.

Illustrated catalogue free.



THE BIELHEN FOUNDRY AND MACHINE COMPANY

St. Joseph, Mo.



Write us for

Stone Saw-Mill Machinery

Please Mention STONE when you write to advertisers.

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NOTES FROM QUARRY AND SHOP.

The large stone quarries of John Heimteck, at Little Rock, N. Y., have stopped work for the present, and about forty men, mostly Italians, are out of work.

Members of the Granite Cutters' National Union have elected W. J. O'Brien, of New York City, and James Duncan, of Baltimore, to represent the National Union at the annual convention of the American Federal of Labor to be held in Kansas City December 12.

Williamsport, Pa.—George Faseno, who has been operating a large stone quarry at Jersey Mills, this county, disappeared from his home three weeks ago, and has not been heard from since. He left a number of creditors and considerable stone ready for shipment. There was due his men for labor over \$700. All Faseno's property has been sold at constable sale to satisfy the labor claims. There are a large number of unpreferred creditors, who mourn his departure. Faseno is an Italian, and has been carrying on an extensive business at Jersey Mills for a number of years, shipping vast quantities of stone from his large quarry. His men claim that he collected all the money he could, then skipped and left them in the lurch. He owed about \$2,000, it is alleged.

The case of Gustav Mielke, who was injured by a premature blast while working in a stone quarry owned and operated by the Chicago and Northwestern Railway Company at Coleman, Sauk county, Minnesota, was decided in favor of the defendant by the granting of a motion for a non-suit. Mielke sued for \$30,000.

Bedford, Ind.—Granville M. Wray, who recently secured judgment against the Peerless Stone Company for \$5,000 damages for personal injury, the judgment being confirmed by the Supreme Court, has filed suit in the Lawrence Circuit Court against the Fidelity and Casualty Company, of New York, and the Peerless Stone Company for \$2,000 insurance which the stone

company carried on its employees. It will be a test case to determine whether or not the injured party can maintain an action against the insurance company in such cases. Unless Mr. Wray can recover from the insurance company it is likely his judgment for \$5,000 against the Peerless Stone Company will do him little good, as the property of the stone company has been sold at sheriff's sale to satisfy a judgment in favor of F. D. Norton.

Members of the Granite Cutters' National Union have elected W. J. O'Brien, of New York City, and James Duncan, of Baltimore, to represent the National Union at the annual convention of the American Federation of Labor, to be held in Kansas City December 12.

Quincy, Ill.—W. D. Meyer has sold his lime business to Koch & Meyers and retired from active life.

G. B. Danforth and Hiram Watson have purchased a marble shop in Carrollton, Ill.

Edwin T. Perry, of Clyde, N. Y., has purchased the granite and marble yards formerly owned and conducted by John H. Cole.

Loudon, Tenn.—It is reported that the Southern Marble Company, of this place, has purchased the plant of the old Standard Marble and Stone Company located here, and that they will enlarge and improve now and will carry on an extensive business manufacturing marble.

Chicago, Ill.—Marble cutters and setters have decided to refuse to handle marble finished at the shop of Davidson & Bros. Marble Company, until they agree to employ union men.

New York City.—Giovanni Turini confessed judgment in favor of Joseph Carabelli for \$3,095, for constructing a granite pedestal for the statue of General Paez, in Venezuela, for the government of that country, between March and August, 1897.

Air Compressors...

Used by
Miners,
Quarrymen,
Stone Yards,
Contractors, etc.,

- * Casparis Stone Co., Marble Cliff, O.
- * Toledo White Lime Co., Martin, O.
- * Atlas Cement Co., Northampton, Pa.
- * Bianchi Bros., Barre, Vt.
- * John A. Rowe, Bedford, Ind.
- * Kunkle & Jordan, Allegheny, Pa.
- * Pioneer M. & Mfg Co., Birmingham, Ala.
- * Anaconda Copper M'ng Co., Butte, Mont.
- * Griffiths & McDermott, Chicago, Ill.



Stone Channelers...

Used in Stone Quarries for producing dimension stone in marketable shape.

Thirty-four Ingersoll-Sergeant Track Channelers used on the Chicago Drainage Canal; also used successfully at the following Quarries: Maxwell Blue Stone Co., Cleveland, Ohio; Romona Oolitic Stone Co., Romona, Ind.; Davidson Marble Co., Gouverneur, N. Y.; Tuckahoe Marble Co., Tuckahoe, N. Y.; Norcross Bros., Tuckahoe, N. Y.; Piedmont Marble Co., Tate, Ga.; Perry, Matthews, Buskirk Co., Bedford, Ind., and many others.

Rock Drills...

23,500 in use in all parts of the World. 300 in the Anaconda Copper Mines alone.



Quarry Bars.—Gadders.—Coal Cutters.—The Pohle Air Lift Pump.

THE INGERSOLL-SERGEANT DRILL CO.

CHICAGO.

NEW YORK.

CLEVELAND.

Avondale, Pa.—The Avondale Marble Company, the plant of which was sold October 27, by the sheriff, will henceforth be made up of James Brown, C. D. Tinsman and F. B. Shaw, all of Williamsport, Pa. The property was purchased by A. P. Reid, Esq., counsel for the three gentlemen above mentioned, for \$10,001. The purchasers were the principal execution creditors, their claim being for \$51,602.30. The other execution creditor was E. H. Hall, whose claim is for \$449. On top of this labor claims to the amount of \$19,106.13 have been entered up. It is said that the total liabilities of the company before the sale footed up nearly \$175,000. The amount of the purchase price—\$10,001—will be paid into court, and it is likely that there will be a warm contest over the distribution of these funds.

Wabash, Ind.—Lew Thorne has assigned for \$10,000, as the result of the failure of Thorne & Wilson, marble dealers, of which he was a partner.

Joliet, Ill.—Mary C. Douglas has sued the Joliet Limestone Company. She seeks to recover the amount of several notes aggregating \$1 020.

New York City.—Execution against Joseph J. Zimmermann, builder, of 1,505 Broadway, for \$3,831, in favor of the Blue Hill Granite Company, of Maine, for balance due on granite for a building.

New York City.—Judgment for \$7,657 was entered November 1 against the David Tulloch Steam Stone Works, formerly at 308 East One Hundred and Eighth street, in favor of Benjamin B. Odell, Jr., and Edward H. Hobbs, as receivers of the Murray Hill Bank, on two notes of the concern made in June and July, 1896, which were found among the assets of the bank.

The Water Power Sandstone Company, Sandstone, Minn., assigned to P. L. Johnson. The company's real estate is valued at \$2,500, and the personal property, including credits and bills receivable amounts to about \$1,000. Assignee Johnson's bond is for \$7,000 and the bondsmen are J. N. Dennis and B. J. Segog.

The Fort Madison and Appanoose Stone Company, Fort Madison, Iowa, with a capital of \$10,000, was licensed to do business in Illinois with a capital of \$9,000.

The deposit of marble located near Wilderville, Josephine county, Oregon, which is owned by Judge Hanna, P. Kelly, of Portland; Ben Bull, of Josephine county, and others, is being negotiated for by a syndicate. The sale will probably take place. The property is quite extensive and valuable, and its development will give employment to many men.

Northfield, Vt.—William W. Holden has sold the so-called Page lot on his farm to Professors Dole and Brill. This sale is of more than usual

interest. Some three months since Messrs. Dole and Brill made a contract with Mr. Holden to allow them to experiment with the slate quarry on these premises. An agreement was entered into providing for further arrangements in the event of the gentlemen being satisfied with their experiments. It seems they are well pleased with what they have already done or the sale would not be consummated. They are now manufacturing slate every day at the quarry, but not in large quantities, owing to the fact that their machinery which has been ordered has not arrived. One of the improvements and a part of the plant which will soon be installed is a sixty-foot boom or mast. From the top of this down to the bottom of the quarry, cable cars will travel, delivering waste and the product. The waste will be carried to the top of the mast and then dumped by a self-dumping apparatus. The slate to be manufactured will be deposited by these cars in close proximity to the saw. Modern machinery is to be put in and the enterprise is practically an assured success.

Charles Ewing, for thirty years a resident of Coldwater, Mich., and proprietor of the Coldwater Marble Works, is dead, aged 64.

Reading, Pa.—Lewis Kreisher and J. F. Turner have formed a co-partnership for the purpose of carrying on a stone business.

Freedom, Pa.—Ex-Postmaster George Jack is opening a stone quarry on the McClure place, New Sewickley township.

Messrs. James Dobson and Charles J. Webb, of Philadelphia, manufacturers; Ralph Beverley, of New York, manufacturer; Robert T. Hopper, Robert D. McGibbon, Thomas Chase Casgrain and William Forrest Robinson, all of Montreal, are seeking incorporation under the name of "The Beaver Portland Cement Company," to engage in the manufacture of cement.

It is rumored that Seneca and Charles Gale are seriously considering the putting in of a \$20,000 cement plant at Morrice, Mich., soon. A very thorough investigation of the business is in progress.

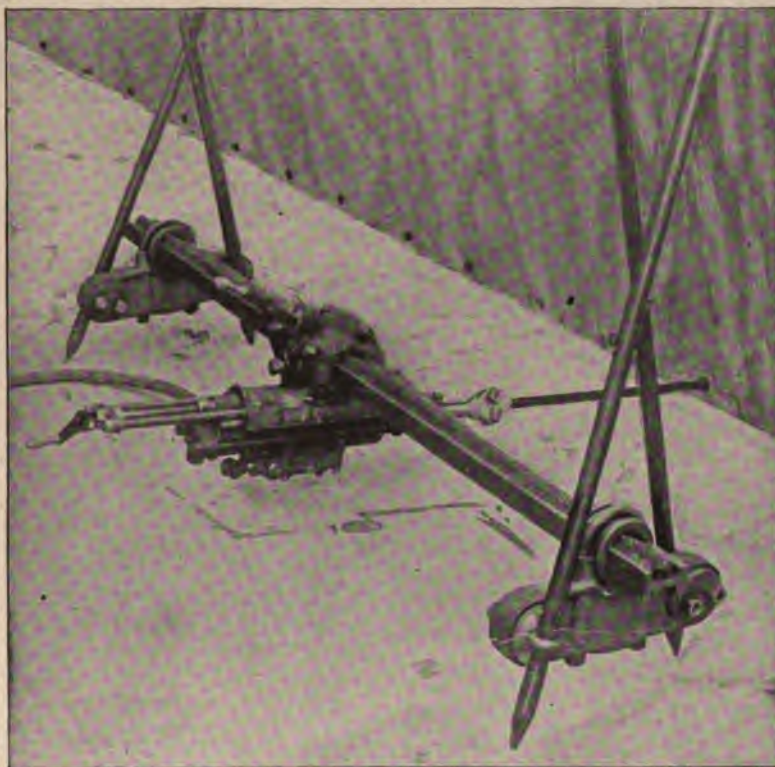
Messrs. Crooks & McLean, formerly of Canton, N. Y., will open granite and marble works November 1, at Carthage, N. Y.

Provo, Utah.—Notices of location were filed by Levi Curtis, *et al.*, of the Thistle Fork marble quarry and the Last Chance marble quarry, situated in Thistle fork, Spanish Fork cañon.

Waterloo, Ind.—Parties were here a few days ago seeking options on the marl lands in this vicinity, and said they would send experienced men here and test the marl within the sixty days they ask options for, and if as represented they will purchase and proceed to the erection of buildings and the establishment of a plant for the manufacture of cement.

Sullivan Quarry Bars
Sullivan Gadders
Sullivan Rock Drills.

RAPID. STRONG. CONVENIENT.



THE SULLIVAN QUARRY BAR.

Channeling Machines for All Kinds of Work.

Contractors for

Prospecting Quarry Lands with Core Drills.

SULLIVAN MACHINERY CO.

Main Office, 54 to 60 N. Clinton St., CHICAGO. Eastern Office & Works, CLAREMONT, N. H.
339 Fifth Ave., PITTSBURGH, PA. 332 Seventeenth St., DENVER, COL.

Please mention STONE when you write to advertisers

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White Pigeon, Mich.—The discovery of marl beds on the farms owned by T. E. Clapp and Frank Timmis, south of the village, have created considerable interest of late in the minds of the people of the surrounding country. Several experts from various places have been here to examine them and plans to extend a railroad to the lands have been discussed. C. Prunez, of Germany, was in White Pigeon for the purpose of examining the marl properties of the land. Mr. Prunez is the owner of large cement works in Germany and is desirous to locate in this country, and it is said offered a large sum of money for an interest in the land owned by Mr. Timmis, which he declined.

Mishawaka, Ind.—Vast tracts of marsh lands in Marshall and Elkhart counties, hitherto shunned by the farmer and considered valueless, are now rapidly passing into the hands of capitalists who have learned the worth of this land through their own and State Geologist Blatchley's recent discoveries in these neglected sections. They contain marl strata of the finest quality. Recently a party of prospectors representing Cleveland and Pittsburg capitalists obtained \$10,000 worth of land southeast of here. The location for a cement factory has been selected near Milford. The cost of the same will be about \$150,000, and a local iron contractor states that the plant will be in operation by May 1, 1899. The work of construction on the Syracuse plant projected by Chicago financiers, and having an estimated daily capacity of 4,000 barrels, will begin November 1. These acres of marsh land were purchased at ridiculously low prices at first, but rates are advancing rapidly.

A number of Louisville people are interested in a quarry near Brandenburg, Ky., from which the finest grade of lithographic stone is being taken, and everything points to the enterprise proving a great success, says the Louisville Post. The stone is said to be far finer than any ever before found in this country, and second only to the finest which is found in Germany, and which is imported to this country annually in the sum of \$200,000. William C. Heinz is president of the new concern, which is known as the American Lithographic Stone Company; Jake Goeppert is vice-president; A. Moreman is secretary, and Frank Kachler is treasurer. All the officers are residents of Louisville, with the exception of Mr. Moreman, upon whose farm on the outskirts of Brandenburg the stone was discovered. The stone is found in a hill over a hundred feet high, and the deposit is believed to cover fourteen acres. It is found in three layers, the top strata being thirty-four inches thick, and the two lower ones twelve inches thick. It seems to be in abundance, and is of a very fine quality. It is now in use in this city and in Cincinnati, and is giving as perfect satisfaction as that obtained in Germany. All the machinery necessary for working the mines has been put in,

and it is expected that within a few weeks the stone will be placed on the market in quantities. The stone is of the same formation as that found in Germany, and, in fact, differs in so few particulars from the imported article that only an experienced lithographer can tell it.

The Western Stone Company refused to prosecute Carl Rost, the young man who embezzled \$5,000 of that company's funds while acting as cashier, consequently he was released from the police station. In speaking of the case the police inspector said: "The stone company refused to prosecute the young man and requested that he be released, and all I could do was to comply with the request. I have had a good deal of experience with criminals and want to say that Rost was not a criminal, and I never mean to assist in making criminals of people. No one denies that he did wrong, but those who know all about the case believe he was merely a tool in the hands of gamblers. He was a very young man and had been with the company fourteen years, and had the officials of that company believe him a good boy."

A new building stone is to be placed on the Salt Lake market. It is a brown stone and comes from the quarries of the Nebo Brown Stone Company, five miles south of Nephi.

The Roberts Brothers—Edward R., William R., Robert E., and John W., have leased from the Hess estate, Easton, for a term of years, a tract of land, in close proximity to the "Star" quarry, northwest of Slatington, Pa., where they contemplate opening a new quarry in the near future. The machinery and paraphernalia or removing top, etc., is being put in position for immediate operation. The quarry is located on the celebrated Franklin vein.

The Consolidated Stone Company has compromised the suit of Mrs. Blanche Gilpin for the death of her husband, by awarding her \$100.—Bloomington (Ind.) World.

Marion, O.—The Cleveland Stone Company filed a common pleas petition against John H. Dwyer, claiming that the defendant is indebted to said company in the amount of \$825 60, for which they pray for judgment, interest and costs.

The Hard Stone-Cutters' Union, of Louisville, Ky., has seceded from the Knights of Labor and joined the federation.

A company supposed to be backed by the Cincinnati, Hamilton and Dayton, is being organized to build a road from Rushville to Laurel, Ind., stone quarries. The shipment of stone over the Whitewater road from Laurel quarries averaged sixteen cars a day this season.

THE WARDWELL Steam Stone Channeling ^{AND} Quarrying Machine

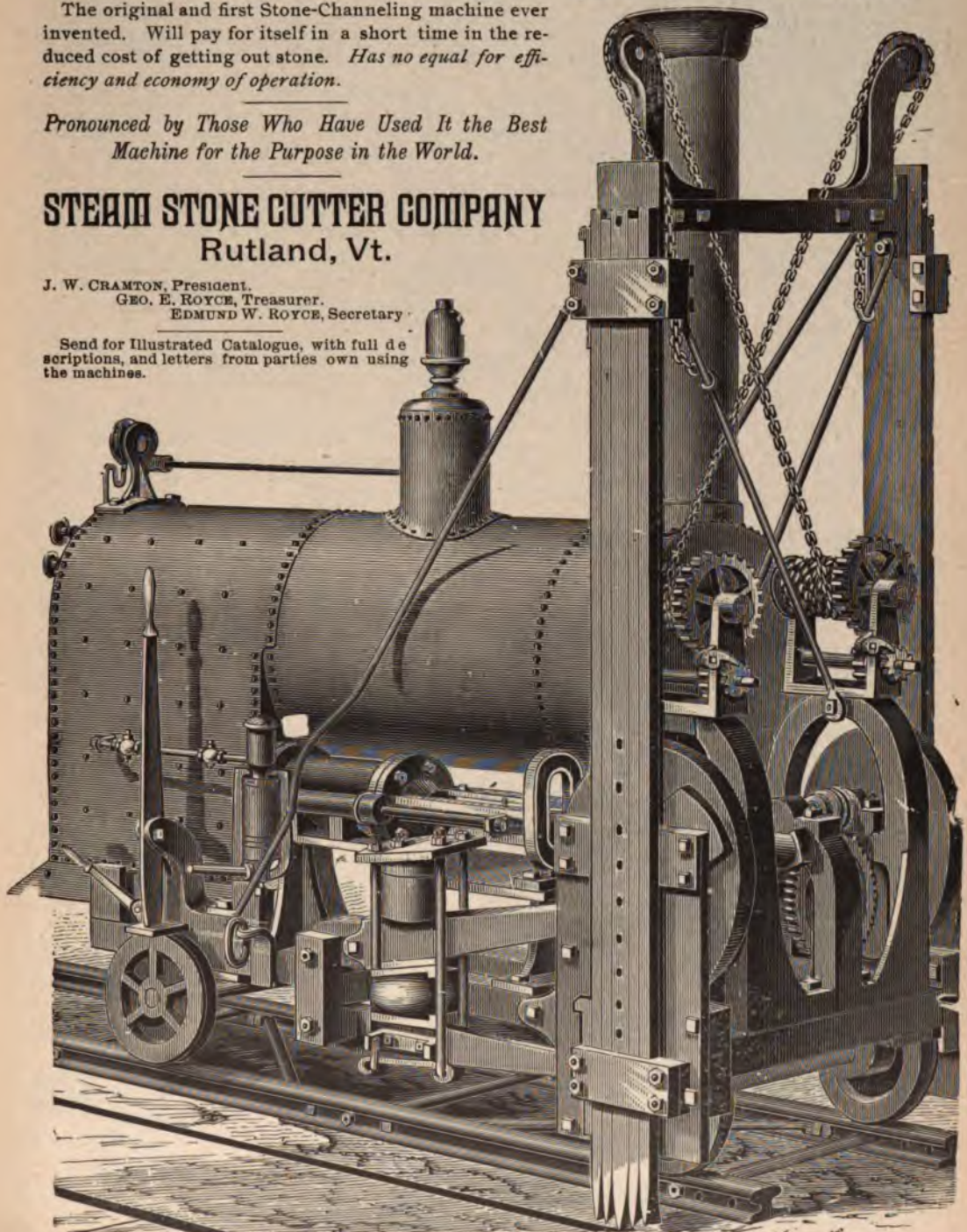
The original and first Stone-Channeling machine ever invented. Will pay for itself in a short time in the reduced cost of getting out stone. *Has no equal for efficiency and economy of operation.*

Pronounced by Those Who Have Used It the Best Machine for the Purpose in the World.

STEAM STONE CUTTER COMPANY
Rutland, Vt.

J. W. CRAMTON, President.
GEO. E. ROYCE, Treasurer.
EDMUND W. ROYCE, Secretary

Send for Illustrated Catalogue, with full descriptions, and letters from parties own using the machines.



The Breckinridge County (Ky.) News says: "Col. Ridgley Cayce, general land and development agent for the Henderson route, was in the city yesterday with a party of quarrymen from Bloomington, Ind. The party came in on the 'Katy,' and consisted of P. K. Buskirk, H. F. Perry, G. K. Perry, Fred Matthews and J. B. Lyon. All are prominently identified with the famous Perry, Matthews, Bnskirk Stone Co., which controls some of the finest stone properties in the Indiana oölitic region. The gentlemen inspected the sandstone quarries below town and were very favorably impressed with the ledge. It is probable that they will acquire the property and develop it on a large scale."

Norristown, Pa.—William P. David's extensive lime establishment destroyed. Loss, \$5,000; partially insured.

The Marquette Coal Company, of New Cumberland, W. Va., for the purpose of acquiring coal and mineral lands by lease or purchase, for mining coal, fire-clay, stone and other minerals. Capital subscribed, \$30,000, with the privilege of increasing the same to \$50,000.

Athens, Mich.—A cement factory is contemplated here at a near date. About \$150,000 would probably be required to equip the factory, which would furnish employment for from 100 to 200 men.

Marshalltown, Ia.—Mayor F. G. Pierce, who with C. H. E. Boardman, owns the Rockton rock quarry, informed a Statesman-Press reporter, that a deal is on with some prominent people of Des Moines, by which it is proposed to put about \$20,000 into the institution and start up on the first of the coming year on a grand scale. It is proposed to employ about fifty men the year round, and get out both building and paving rock. The Des Moines parties referred to are at the present time interested in several of the largest brick plants in the country.

The Michigan Alkali Co., of Wyandotte, Mich., will erect a large plant at works No. 1 for the manufacture of Portland cement from the refuse of the works.

John B. Miller, of Dubuque, has decided to locate in Waterloo, Iowa. He is a stone-cutter and cut-stone contractor.

Wabash, Ind.—The Bridge Bros. have purchased from their mother the stone quarry which was formerly owned by Thomas Bridges.

Bedford, Pa.—The marble and granite business of George A. Rush and brother will be continued for the present by Rush C. Litzinger, administrator.

Edwin T. Perry, of Clyde, N. Y., has purchased the granite and marble business of Mrs. John W. Cole, and will continue the business.

Salt Lake City.—The promoters of the Hobbie Creek Marble Company, whose articles of incorporation were filed sometime ago, are preparing for a most energetic campaign at the quarries, and promise to make them the foundation for another most profitable industry in Utah. The incorporators are among the state's most representative men. Hon. Allen G. Campbell is the president; Don C. Robbins, vice-president; Capt. Timothy Egan, the treasurer, and J. L. Perkes, secretary. Associated with these gentlemen as directors are Mathew T. Cullen and W. A. Byers. The property of the company consists of 1,000 acres of marble-bearing lands in Hobbie Creek canyon, about nine miles east of Springville, Utah county, the material presenting itself in light brown color, picturesquely marked and capable of a polish of the highest character. The ground has already been prospected to an extent sufficient to establish the permanency of the deposits, and with abundant water for power purposes, the material should be handled on a most economical scale.

Newark, N. Y.—The marble and granite firm of Utter & Hilmire has been dissolved. Mr. Utter has retired.

J. J. Archie & Sons, of Waterloo, Wis., have bought the property of the Watertown Stone Company, located in the city of Watertown. The plant is a valuable one, being well supplied with all kinds of machinery necessary to run the business. They will commence operating the plant about November 1.

Machias, Me.—Vose Bros. have leased the Head Harbor Island granite quarry to the Metropolitan Granite Co., of New York. Thirty-four stone cutters and twenty-five quarrymen are employed.

Hummelstown, Pa.—J. M. Tilley has leased the Hofferton Blue Stone Quarries, and will hereafter operate them on a large scale.

The Little Falls Granite Company, situated at Gravelville, Minn., are considering the advisability of moving their cutting and polishing plant to Little Falls, Minn.

Corsicana, Tex.—T. C. Stribbling, engaged in oil development here, states that he is in possession of knowledge of a quarry of excellent building stone in this county, not a great distance from Corsicana, and that he is now taking steps to develop the same.

It is reported that the granite works at Calais, Me., will resume business with a full force.

The Dodlin Granite Co., of South Norridge-wock, Me., have been doing more work, with a brighter outlook than for some time past.



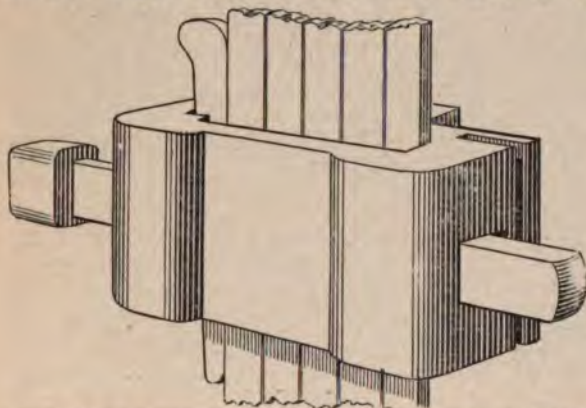
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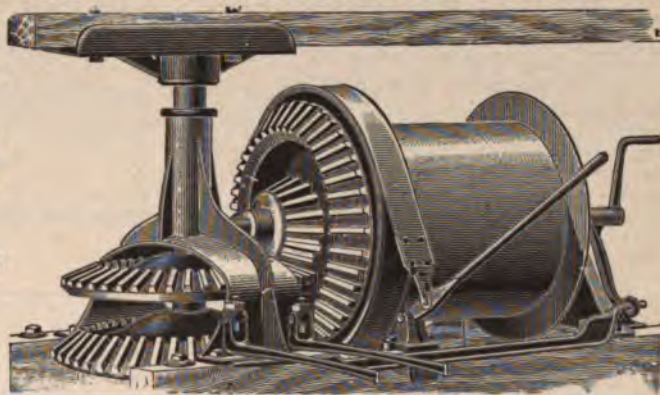
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xvii

Sacramento, Cal.—Israel Luce, a pioneer Californian, who was for nearly twenty-five years, engaged in the marble business in this city, dropped dead from heart disease. He was a native of Ithaca, N. Y., aged 73 years. Luce arrived in California in May, 1849.

Richmond, Va.—Michael Byron, deceased, born in Ireland, but has been a resident of Richmond for twenty-five years, and until the past few years has been engaged in the stone business as senior partner in the firm of Byron & Rennie.

Wabash, Ind.—The marble works of Thorne & Wilson have been placed in the hands of a receiver, James McCrea being named to take charge of the firm's affairs.

The Indiana Supreme Court has affirmed the \$5,000 judgment against the Peerless Stone Company, of Bedford, Ind., in favor of Granville Wray for injuries received; in litigation since 1892.

The Excelsior slate quarry, located near Danielsville, Pa., was seized by the sheriff, on an execution for \$1,501.60, in favor of S. J. Packer and H. E. Davis.

Chicago, Oct. 21.—Edward R. Brainerd filed a petition for voluntary bankruptcy in the United States district court yesterday. He asks to be relieved of liabilities aggregating \$357,739.76, and scheduled assets in the form of accounts receivable and stock in corporations of the nominal value of \$588,932.57. The larger part of the liabilities consists of accommodation paper to the amount of \$231,039.76. The remainder of the liabilities is \$126,700 in promissory notes and \$75 in cash. A small part of the promissory notes is secured by real estate mortgages, and the great majority of the liabilities are due trust companies and banks in Vermont, Massachusetts, Illinois and several other states. Cash advanced to marble companies in which the petitioner was formerly a stockholder and open accounts for merchandise comprise \$173,923.57 of the assets. The corporation stocks listed as assets consist of the following: Stock in Smith-Brainerd Marble Company, \$250,000; Davidson Marble Company, \$130,000; Brainerd Marble and Granite Company, \$35,000.

Columbus, O.—John Murphy, doing business as John Murphy & Co., manufacturers of Portland cement and general contractors, filed a deed of assignment to Florence D. Sullivan. The assets are estimated to be worth by Mr. Murphy's attorney, about \$18,000, while the debts are fully up to that figure.

St. Cloud, Minn.—The Rockville Granite Company property, including the polishing plant and all other machinery, and two acres of ground, upon which the buildings are located, was sold at auction at Rockville. The purchaser was Henry Alexander, one of the company members, who will continue the business under the company name. The consideration was \$3,400. The company has a lease of the quarries, which belong to O. Tenny, of this city.

Groton, Vt.—A stock company called the Pine Mountain Granite Manufacturing and Development Company has been formed to open the quarry on Pine Mountain and sell rough and finished granite. The capital is \$250,000, and it has for its president C. D. Welch, of Boston; vice president, L. Raymond, North Haverhill, N. H.; secretary, J. B. Dyer, Concord, N. H., and treasurer, I. M. Ricker, of Groton.

Topeka, Kan.—The Roman Cement and Plaster Company, with offices at Springvale, Kan., St. Joseph, Kansas City and Cameron, Mo., filed its charter. The capital stock is \$6,000. The directors are John W. Bichel, Anna S. Payton, Clarence O. Thomas, Cameron, Mo.; Davis T. Burns, Samuel T. Wells, Benjamin T. Bichel, Springvale, Kan.

Operative Stone-Cutters' Association, of Illinois, Chicago. Incorporators, Abraham B. Mills, William Small and Joseph Bouller.

Fire at Honesdale, Pa., destroyed M. Canfield's marble works.



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xviii

BOOKS AND PERIODICALS.

"SONGS OF WAR AND PEACE," by Sam Walter Foss, author of "Back Country Poems," "Whiffs from Wild Meadows," "Dreams in Homespun," etc. Cloth. Gilt Top. Boxed. Lee & Shepard, publishers, Boston. Price, \$1.25.

A reviewer says: "There is an inspiration breathing through the lines of Mr. Foss' verse that appeals to all, and in his latest volume are included thoughts, comments, and satires on modern topics that are either strikingly humorous or strikingly pathetic—either way most impressive, and permeated with novelty of idea that often tickles the fancy immeasurably. Mr. Foss keeps abreast the times, several of his poems being on war subjects. The initial poem of the volume has been largely quoted by the press of the country. It is entitled 'War.'

'When I speak the centuried towers of old cities melt
in smoke,
And the fortified ports sink reeling at my far-aimed
thunder stroke;
And an immemorial empire flings its last flag to the
breeze,
Sinking with its splintered navies down in the unpy-
ing seas.
But the blind of sight awaken to an unimagined day,
And the mean of soul grow conscious there is great-
ness in their clay;
Where my bugle voice goes pealing slaves grow heroes
at its breath,
And the trembling coward rushes to the welcome arms
of death.'

His verse has always beauty and grace, even when humorously characterized; and beneath the humor often a touch of the keenest human reproach and sadness. He probes more than ordinary depths and draws up more than most people catch even a glimpse of. In every outward sense the work will appeal to those who love beauty in the clothing of books, for its cover is a specially dainty piece of artistic skill."

"UNDER DEWEY AT MANILA, OR THE WAR FORTUNES OF A CASTAWAY," by Edward Stratemeyer. Cloth. Illustrated. Lee & Shepard, publishers, Boston. Price, \$1.25.

Nothing approaching in martial interest the story of Larry Russell and his fortunes, resulting in heroic service on the "Olympia," has appeared since the famous Army and Navy Series by Oliver Optic. Furthermore, it is the only popular book ever written that presents life in the modern navy. The sea stories that have so charmed young and old are obsolete, and Mr. Stratemeyer is the first to show what a boy would find on a battleship of to-day. This combined with a vivid and accurate description of the memorable contest at Cavite, and the rich store of historical and geographical infor-

mation skilfully presented marks the book as one of the greatest successes of the year. The chapter telling the story of Admiral Dewey's life is of special interest. The hero, while full of a life and vigor that render him abundantly able to take care of himself in his perilous adventures, is manly, true, and clean throughout, rendering the book wholesome as well as thrilling. The succeeding numbers will fully sustain the interest. To be followed by "A Young Volunteer in Cuba, or Fighting for the Single Star." (In November.) "Fighting in Cuban Waters, or the Haps and Mishaps of a Young Gnnner."

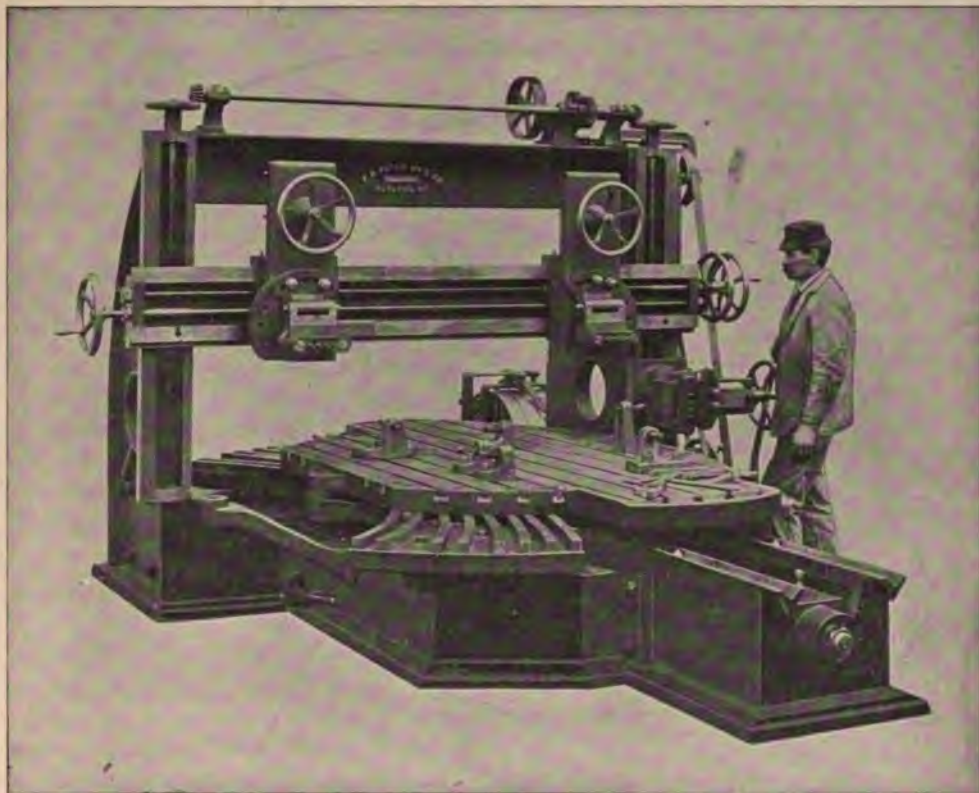
The leading features of the American Monthly Review of Reviews for November are: the editorial comment on the State and Congressional campaigns (illustrated); an illustrated account of the work of the "Y. M. C. A." in connection with the army and navy during the connection with the army and navy during the war with Spain, by Albert Shaw; an article on "The Newspaper Correspondents in the War," with numerous portraits; Mr. Creelman's own story of his Santiago adventures; "Ouida's" "Impeachment of Modern Italy," with Signor Vecchia's reply; "The Nicaragua Canal in the Light of Present Politics," by Prof. L. M. Keasbey; and "The Nicaragua Canal and Our Commercial Interests," by Dr. Emory R. Johnson.

"Architectural Forms in Nature" is the title of a fully illustrated paper by F. S. Dellenbaugh in Appletons' Popular Science Monthly for November. The strange contours and striking resemblances to the works of man, which the forces of Nature, unaided, have so frequently produced, form a subject of inexhaustible variety and interest, and Mr. Dellenbaugh, taking advantage of its possibilities, presents a most readable and instructive account of some of the more curious and well known of these "natural wonders."

The complete novel in the November issue of Lippincott's, "A Triple Entanglement," by Mrs. Burton Harrison, has its scenes mainly in Spain and England. The hero is an American, whose course of true love does not by any means run smooth, but leads him into safe harbor at last. The tale is one of this favorite author's best, and perhaps the longest which has ever appeared in Lippincott's.

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xix

CONTRACT NEWS.

Boone, Iowa.—An election has been called for November 17, to vote on the question of issuing \$10,000 in bonds for the erection of a jail. M. D. McGregor.

Wahpeton, N. D.—The question of issuing \$18,000 jail and sheriff's residence bonds will be voted upon at the general election.

Englewood, N. J.—A committee has been appointed to secure plans and specifications for a \$35,000 church, to be erected by St. Paul's Episcopal Church. George F. Flichtner, rector.

Richmond, Va.—Plans are being prepared at the Washington office for the erection of a new depot by the Southern Railway Company. C. M. Hudson, chief engineer, Washington, D. C.

Alton, Ill.—A movement is on foot to erect a \$20,000 Y. M. C. A. building.

Hot Springs, Ark.—The Superior Lodge of Knights of Pythias, of Illinois, has received a ninety-nine-year lease of property at Hot Springs for the erection of a sanitarium which will cost \$500,000.

St. Paul, Minn.—Herman Kretz & Co. have prepared plans for a new three-story building, to be erected by the St. Joseph Orphan Asylum. Estimated cost, \$36,000.

Galena, Ill.—At the November election the question of issuing \$20,000 court house improvement bonds will be voted upon.

Vinton, Iowa.—A vote will be taken November 8 on the question of issuing bonds for the erection of a court house. B. F. Mossmore, clerk of board.

Springfield, Ill.—The Sangamon county people will vote November 8 on the proposition to expend \$100,000 on court house improvements.

Yates Center, Kan.—At the November election the people will vote on the question of issuing \$30,000 in bonds for the erection of a court house and jail.

Oldenburg, Ind.—D. A. Bohlen & Sons, of Indianapolis, have prepared plans for a \$175,000 school and convent, to be erected by the Sisters of St. Francis. Bids are being taken.

South Hadley, Mass.—Contracts will soon be let for the erection of a \$50,000 dormitory, to be erected at Mt. Holyoke College.

Thornton, Ill.—Oscar L. Murry, Chicago, has prepared plans for a \$35,000 school building to be erected.

Minneapolis, Minn.—The Board of Regents of the State University will ask the coming legislature for appropriations for two detached fireproof buildings, to cost each \$50,000, and an additional story to the Chemical Building, at an expense of about \$20,000.

St. Louis, Mo.—The United Hebrew Charities has purchased a site for the erection of a \$20,000 building.

Douglas, Ga.—Coffee county will build a new court house to replace the one recently burned. D. W. Gaskins, county clerk.


Marshall, Mo.—An election will be held November 8, to vote on the question of issuing \$30,000 in bonds to build a jail in Saline county.

Paris, Ill.—The Presbyterian Society is taking steps toward the erection of a new church. R. M. Link, W. J. Hunter and C. H. Hodge have been appointed a committee to correspond with architects.

The question of erecting a monument to the memory of Mrs. Julia D. Tuttle is being agitated by the citizens of Miami, Fla. Most of them favor the movement, and it is thought that a suitable and handsome monument will be put up.

The Atlanta Journal heads a list with \$25 to raise a monument to Miss Winnie Davis, in Richmond. Subscriptions to the fund have been coming in rapidly since the monument is assured.

Penn Yan, N. Y.—The movement that has been on foot for some time to erect a monument over the remains of the late John L. Lewis, in Lake View Cemetery, seems now to be nearing success, as the necessary amount to raise the monument, \$2,000, has been pledged. An additional \$500 was pledged at the conclave of the grand commandery, Knights Templar, of this state, held at Geneva, thus virtually making the project a success. The monument will doubtless be erected some time next year.



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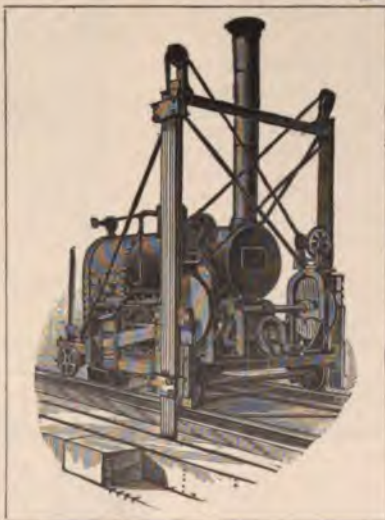
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xx

Rochester, Minn.—Custer Post, G. A. R., of this city, proposes to erect a monument in memory of old soldiers of Olmstead county, whose names will be engraven thereon. The structure will cost about \$2,500.

The citizens of Sioux Rapids, Iowa, have raised by popular subscription considerably over \$100 for the purpose of erecting a monument over the grave of Abner Bell, the pioneer settler of northwest Iowa.

Cincinnati, O.—The University of Cincinnati has received a donation of \$56,000 for the erection of a fireproof library.

Detroit, Mich.—Architects Joy & Barcroft have prepared plans for a mausoleum for Maxwell M. Fisher, to be 8x18 feet, with six catacombs, built of granite, have polished marble finish, mosaic marble tile floors, marble lining of walls and ceiling, inner door of marble and outer door of solid bronze. Cost, \$10,000.

Chambersburg, Pa.—The trustees of Wilson Presbyterian College are taking first steps toward the erection of a \$75,000 college building.

Dubuque, Iowa.—Architects Buecher & Jacobson, St. Paul, Minn., have prepared plans for a new seminary building for the Theological Seminary, estimated cost, \$250,000.

Keyser, W. Va.—Bids will be received by the county clerk until February 10 for constructing a new county jail. Estimated cost, \$10,000.

Garner, Iowa.—It is stated that bids are wanted November 1 for a stone court house. Cost \$30,000. F. W. Kinney, architect.

Detroit, Mich.—The judiciary and the ways and means committees of the common council decided to recommend that the Board of Public Works be instructed to cancel the contract with Spitzley Bros. for the proposed G. A. R. Memorial building and re-advertise for bids, admitting all kinds of building stone to competition, and with the understanding that the bids must come within the \$38,000 appropriation.

Waterloo, Iowa.—The question of issuing court house bonds will be voted upon at the November election. H. D. Williams, county clerk.

Cleburne, Tex.—Evans & Horbons are arranging to erect a business building and opera house. Estimated cost, \$40,000. E. H. Silver, Dallas, architect.

Columbus, O.—The Cumberland Presbyterian Society is taking the first steps toward the erection of a new church. Rev. Chas. D. Watson, pastor.

Waynesboro, Pa.—The M. E. Society has accepted plans prepared by W. O. Weaver & Son for the erection of a \$15,000 church. Bids will not be received until January.

Shelbyville, Ky.—The county court and the city council have started a movement for the erection of a \$50,000 building for the city and county.

Steubenville, O.—The plans for the new Holy Name Church building have been practically completed, and all the contracts are to be let this fall and winter, in order that the work may be commenced early in the spring. There is now over \$20,000 subscribed to the building fund for the new church. Rev. James J. Hartley, pastor.

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xxii

Steubenville, O.—The Methodist Protestant congregation at Steubenville has decided to erect a new church building to cost \$25,000.

Cincinnati, O.—The Board of Directors of the University of Cincinnati, will receive bids for the excavation and masonry, brick work, cut-stone work, cement work, roofing, marble work and tile work required for the south wing, known as Cunningham Hall, of the new university building, November 10. Drawings and specifications can be seen at the office of S. Hannaford & Sons, architects. J. G. Schmidlapp, chairman.

Grosse Point, Mich.—Harry J. Rill, Detroit, has prepared plans for an \$18,000 church to be erected in connection with the Academy of Sacred Heart at Grosse Point.

Wilkesbarre, Pa.—The county commissioners decided to build a four or five-story court house at a cost of \$500,000. The plans of Architect Meyers, of Detroit, for which the county has already paid \$10,000, will not be utilized. The commissioners will ask for competitive plans from architects, and the most desirable of these will be accepted.

Palmyra, Mo.—The St. Joseph Catholic Society is taking first steps towards building a \$15,000 church.

Louisville, Ky.—The members of St. Boniface Church will let the contracts for the erection of a new church edifice and rectory some time in December or January. The plans will be in the possession of the board in about three weeks. Rev. Lucas Gotteboede, 519 E. Green St., rector.

Newport, R. I.—Architect J. D. Johnston has prepared plans for a new city hall for this city. Indiana limestone, brick, black slate roof, marble work; \$125,000.

Oskaloosa, Iowa.—An election will be held November 8 to vote on the question of building a new jail at an expense of \$20,000. J. B. Cruzen, auditor.

Columbus, O.—The Cumberland Presbyterian Church has purchased a lot, and plans will be adopted at once for a church and parsonage. The building and parsonage to be erected will cost from \$15,000 to \$20,000.

Xenia, O.—The question of building a new court house will be voted upon at the election next month. J. H. McPherson, county auditor.

Marietta, O.—The question of building a new court house will be submitted to the voters of this county at the election November 8. L. E. McVay, county clerk.

Toledo, O.—The proposition to issue \$300,000 of bonds for the erection of a new city hall will be voted upon at the election in April, next year.

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Is used by all the leading firms—saws faster and better than any other sand-feed. More gangs using our feed than any other. Easily kept in order. Also many gangs working satisfactorily, using crushed steel. Can give best of references.

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HS

the 1990s, the number of people in the UK who are aged 65 and over has increased by 1.5 million (1990–1999) and is projected to increase by a further 1.5 million by 2010 (Office of National Statistics 2000).

There is a growing awareness of the need to develop strategies to meet the needs of the ageing population. The Department of Health (2000) has identified the need to develop a new paradigm of care for the ageing population, one that is based on the concept of 'active ageing'. This paradigm is based on the idea that ageing is a process, not a state, and that the goal of care should be to promote the health and well-being of older people, rather than to simply manage their decline.

The concept of 'active ageing' is based on the idea that older people should be able to participate in the activities of everyday life, and that they should be able to do so in a way that is meaningful and enjoyable. This requires a range of services and support, including housing, transport, and social activities. The Department of Health (2000) has identified a number of key areas for action, including: improving the health of older people, promoting their social participation, and ensuring that they have access to the services and support that they need.

The concept of 'active ageing' is also based on the idea that older people should be able to contribute to society. This requires a range of services and support, including housing, transport, and social activities. The Department of Health (2000) has identified a number of key areas for action, including: improving the health of older people, promoting their social participation, and ensuring that they have access to the services and support that they need.

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